The Colorado Quarterly

THE UNIVERSITY OF COLORADO

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JEROME S. BRUNER

The Impact of Quantum Mechanics
EDWARD U. CONDON

Windows to the Sky
PHILIP MORRISON

The God of Fiction
CHARLES I. GLICKSBERG

The Lesson of the French Crisis
MIREILLE BABAZ *and* ALFRED FONTENILLES

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(Continued on page 221)

The need for new myths

JEROME S. BRUNER

We might begin with a popular premise, one so often voiced these last years that we perhaps do a service to rescue it from the trash heap of banality where it risks resting, there to be poked at by those who make a profession of angry and pious debate. It is the premise that the West is faced with a crisis in values, that we have fallen into a state of deep doubt and fear about what we seek as the objective of the Good Society. There has been much easy speculation about the origins of this crisis, and many more remedies proposed: return to a consideration of religious values; appeals for the abatement of materialism or pragmatism; the renewal of nerve; celebration either of the values of the humanist or the scientist.

In the realm of foreign policy, an issue to which we shall finally return, the exhortations have reflected this deeper confusion of values. On one side we are urged to be more realistic, to recognize our position of strength and develop the art of the possible, lest, like Edmund Burke's French revolutionaries, we create a condition where man is blindly inhuman to man in the very pursuit of moral perfection. On the other, idealism is urged. We are warned that *Machtpolitik* and a reliance on horse-trading diplomacy will lose us the position to which our heritage entitles us in the world: "How can I be against a country that produced *Huckleberry Finn?*" the new Prime Minister of Ceylon, in vicarious pride of American ideals, was reported to have said at a press conference. There are those who would have us more flexible in our foreign policy, and still others who urge that what is wrong is our callow lack of sense of tragedy, an assumption that policy can be changed as easily as we change a necktie that no longer matches our mood. I would urge that the contradictory chorus of advice in the field of foreign policy reflects the deeper uncertainty about the values we affirm as a society—and the West is a society, one in which we exchange goods, poetry, Mickey Mouse, delight in rejecting the

conservation of parity in physics, and the other viable agents whose safe passage across boundaries provides a better basis for gauging the limits of a community than any regional pact or international agency.

My premise, which I shall try to develop more in a metaphoric than a systematic spirit, is that the chorus of voices calling for a reconsideration of values sings of a deeper more hidden crisis. It is a crisis that has to do with the nature of myths, the guiding myths in terms of which men conduct their enterprises and in the image of which they set their ideals. They are myths about the nature of the universe and its order—and physicists are quick to call what they are doing myth construction, for the nominalistic spirit of modern physics is precisely of this order. And the concern is with myths about the nature of man, his rationality, his passions, his place in nature. And most visibly, we are uncertain about the myths of the ideal society and the nature of its proper change, whether progress, decay, or maintenance.

The myth-making function is peculiarly a function of the intellectual. The masses of men principally dispose, the intellectual proposes. Let us not, by the way, dismiss the deeper scientific myths as irrelevant. We believe, for example, that time flows equably and inexorably—common sense believes it and watchmakers reinforce the notion with their handicraft. The people of Nuer do not believe it: time is inherent in the act performed. Nor does the quantum theorist in physics operate with such a myth. So, for us the ultimatum and the deadline crises are "real." There can be no such crisis in Nuer or in quantum theory.

As Freud said, writing to Einstein about war and psychoanalysis, "All this may give you the impression that our theories amount to a species of mythology and a gloomy one at that! But does not every natural science lead ultimately to this—a sort of mythology? Is it otherwise today with your physical science?" I bring up the role of the intellectual at the outset, for I think that today there is a deep division in the intellectual community that has strangled its power as an effective source of myths for our time.

To gain some perspective, I should like first to examine the conflict and division that exists in the community of intellectuals, its background, wherein it is an expression of vanity, why its resolution is a matter of profound political concern, and yet why the

conflict cannot, like the Religious Wars, be ended by a Treaty of Westphalia. The attempt, I should forewarn you, is an essay in the history of man's loneliness in the world. In the end, I shall have no proposals to make; only a hope to express.

When Henry Adams wrote of the twelfth century as a moment of unity in the West, communal effort directed *ad majorem gloria Dei*, he was perhaps too simple in proclaiming that "all the steam in the world could not, like the Virgin, build Chartres." Yet, in that moment the world was palpable; energy was an extension of the human arm; the universe was a unitary creation and not, in the playful pun of Robert Oppenheimer, a multi-bonded pluriverse; man on his earth stood at the center of the universe, however malnourished and unsanitary his plight. The mysteries were well packaged, presided over by a God and a Devil, and wise men sought to elucidate the former and exorcise the latter. Knowledge whatever its form was a matter of certainty not of probability, and the two routes to its attainment, Revelation and Reason, were well charted: the first in systematic theology, the second in the logic of Aristotle. To be an intellectual was to be a believer and a member of a community of Schoolmen: one needed little extra briefing to move easily from Burgos to Oxford to Paris.

It is perhaps worthwhile to consider very briefly the series of shocks that most directly bear on our present plight, shocks that had the effect of altering man's image of himself and of his world. First he was displaced from the center of the universe, literally so by the Copernican revolution. The universe did not revolve around us. With Copernicus, we became a thread in the tapestry of celestial motion, a highly ordered tapestry in which the Earth's role was peripheral. Man's power rested not in his celestial position, but in his capacity to know about the heavens. And for the intellectual, the knowing was such heady stuff that centuries later Jonathan Edwards, upon having read in the Proceedings of the Royal Society of Newton's prismatic decomposition of white light into the colors of the spectrum, could preach on the American frontier at Northampton that man was indeed capable of unlocking the secrets of God. But while a triumph of knowing had been achieved, the common man had nonetheless been displaced from the center.

The rise of science in the intervening centuries, particularly of

physics and the biological sciences, had much the same effect. The pattern of development was to render man and his immediate world as special instances of more general laws. Things were not as they appeared to the common sense: a body in motion would stay in motion. It remained for the nineteenth century to accelerate the pace. Darwin displaced man from his unique position and made of him the resultant of a long biological pre-history, his form determined by the manner in which chance variation happened to fit the demands of habitat pressure. Then in rapid succession there came a series of shocks. Up to now, man had been able to conceive of energy in terms of the classical mechanics, pushes and pulls of a kind that parallel the operations of the human body. But with the formulation of principles of electricity, new and incomprehensible modes of energy emerged, and the image of the human arm as the work creator was displaced. By the end of the century, a new formulation of man appeared on the horizon, Freud's conception of the relation between reason and unreason, his questioning of man's boast of rationality.

It remains for our own century to create a crisis of a new order, one that is still little understood, but one which is deep and revolutionary in its implications. During the preceding centuries, there had been little doubt about the nature of the process whereby we came to know nature. Newton's image was the prevalent one. The scientist was a voyager on a sea of discovery, attempting to find the islands of truth. Discovery was discovery and positive knowledge was an obvious concept. The advances of the twentieth century have been premised on a radically different conception. The data of science are the experiences of the scientist; nature is inferred from the regularities of experience; it is never directly and naively known. The nature of the scientist's data is determined by the vantage point from which he experiences events, and there can be no fixed or "bench-mark" viewing points. What is the velocity of the viewing point from which one attempts to measure the velocity of an object going by? From such queries came the conception of relativity and, perhaps a more telling consequence still, a new conception of the nature of knowledge: the fictive theoretical model as a substitute for the naive literal conception of nature lying out there to be observed. These models are the creations, the inventions of man—not his discoveries. Clerk

Maxwell's field equations were not discovered in the sense that Columbus discovered America, but in the manner that Dante created the *Divine Comedy*. So too the model of the nucleus of the atom. There is no assumption that one day we will find a set of spinning particles; indeed the particles are concretizations of the journalistic mind. What there is, is simply a set of equations, highly condensed descriptions of constructed processes. From time to time one is able to make an observation that throws some light on the adequacy of the model. But test it directly one can never do, any more than one may test the fit of the *Divine Comedy* to human experience.

Each great change in man's conception of nature, each great stride in our way of knowing, has brought with it not only a change in technology—insofar as such fruits were to be reaped—but also a change in conceptions or myths about man. It is in this respect among others that the humanist and the philosopher have served as enrichers, creators of great myths about man, his world, and the nature of good. There has been perforce a long lag in the change of conception of man, for we cherish our image of man and suffer innovations in even its details with steadfast gracelessness. But change there is. The Cartesian dualism of mind and matter was a response to the schism that had already developed in man's view of man on the one hand and of nature on the other. With the advance of the physical sciences, the image of man was increasingly shifted in the direction of the world of physics; and Hobbes, La Mettrie, and Malebranche proposed a completely materialistic view of man. With the success of the Newtonian revolution, there came into vogue a push-me-pull-you mechanistic model, man continuous with the mechanical forces of nature. Nothing is in the mind, proclaimed Locke, save what was written there by the senses. The result, we all know, was an increasing alienation of the humanist who would celebrate man and of the naively realistic scientist who would reduce him to "nothing but" nature. The romanticists among the philosophers, the rise of the novel in the eighteenth century, the deep alienation of the poet and the scientist as the nineteenth century wore on, the defensive posture of the religious—all of these splits within the community of men of thought and sensibility have made it increasingly difficult for

us to find world views, philosophic myths, that could at once comprise our expanding view of nature and our appreciation of man.

The irony of this state of affairs for our times is that today the new conception of science has a deep kinship to the arts of the poet. The poet constructs an image of the world and of man's experience of it, again in much the same spirit that today's physicist on the frontier constructs his image of nature. Each is an elaboration based upon fragments of experience—highly instrumented and specialized and lonely experience for the physicist, more direct and humane in the case of the poet.

Yet here in the present we find our community divided. On the one side is the more beleaguered type of humanist, shrill in his denunciation of the sciences, their values, their works; on the other the anti-humanistic scientist. It is the quality of the shrillness of the humanists that most disturbs me. It is a shrill cry not to look, not to see, to turn one's back on the enterprise and not to know. This type of humanist offers a new myth of man without a philosophy of nature, without a way of relating man to nature. In its place we are urged to make a journey into the interior, to examine the roots of our despair, to find our identity within ourselves or in relation to a transcendent image of God, a God for man but not for the universe in which man lives. That is the domain of the ungodly physicist who plagues us with his ghastly atomic age. This humanist's province is man and those of his works that are acceptable to the humanities. (Desmond Shawe-Taylor has a magnificent if imaginary program note for the avante-garde music of this tradition, inspired by a piece in *The Score* that recently proclaimed that "to express and give form to the disquiet that marks our epoch" is the function of truly modern music. Shawe-Taylor's program note: "The brass re-enters with a crushing affirmation of despair, and the symphony comes to an end with a brief but shattering reference to the motto-theme, hammered out *con tutta forza.*")

There are anti-humanistic scientists who, for their part, are scarcely more enlightened. Encouraged by the metaphysical excesses of the anti-metaphysical analytic philosophers, they will cheerfully remind you that in terms of analytic criteria the utterances of the humanist, the novelist, the poet, and the moralist are

in principle non-testable and empirically empty and, therefore, as far as the workaday world of the scientist is concerned, "cast them unto the flames for they are naught but sophistry and illusion." And in their spare time, just as the embattled humanist has no displeasure in using the technological by-products of science while condemning its process, so the scientist will read with pleasure the poems of Rimbaud, the novels of James "for recreation." If the contemporary humanist wants his professional world, his working myth, to have no nature in it, so the scientist (and most psychologists are no exception) wants his professional world myth to be without men—at least without whole ones who have anxieties about the nature of man, who construct metaphysics and write quartets. If they are let in, their status is stripped to the irrational origins from which they sprang.

Now what, you may ask, does all this have to do with the affairs of the world, its crises and alarums, with the alleged failure of the foreign policies of the Western nations, the crisis in whose cultural development I have been sketching?

The first point I would make is that without a myth of man and his place in nature that is adequate to the technological realities of our times, there can be no relevant or effective political philosophy. For myths must fit the human condition of the time and place; otherwise they can only be a source of anxiety and confusion. If our myth of man is that he is powerless, declining, and therefore wracked with *Angst* and if, at the same time, man is releasing new energies by the megaton per shot, then the fit is poor. Or if happiness is posited and proclaimed as the natural state of man, and man is then cast into a state of urbanized loneliness, even such ads as this one in a Washington paper, part of a concerted campaign of "advengelization," will not stem the malaise: "The biggest crowds can be the loneliest places. The Church can show you the most satisfying way of never feeling alone again."

Because we have not come to terms with the uneasy task of conceiving of man, his society and their place in nature as the central challenge, we have, I would submit, entered a stage in which we are engaged in what can only be called a moral holding

operation. Its central ideal, its myth, is the ideal of adjustment, of being comfortable, of keeping the show on the road, of not making fusses, of taking man from the psychologist's point of view and culture from the anthropologist's. It is the ideal of whistle-while-you-work and be well adjusted and don't make waves. There is a huge irony in the emergence of this bland view of man (and no view of nature) at this particular moment in history when we are perhaps more embattled intellectually, spiritually, and morally than ever before in human history.

The Dramatic Society of a great Eastern university produced a most excellently staged *Hamlet* this past season, and it was not until several days after seeing it that I realized why I had found the famous soliloquy so altered, so lacking in anguish. It was a Hamlet speaking who had undergone a successful psychoanalysis. The soliloquy was a laying out of the alternatives, spoken as a well-adjusted man at tether's end would speak. In place of anguish, there was the sardonic striking of an adjusted balance. In the end, Hamlet could not decide—much like a well drawn character in a Mary McCarthy novel.

Adjustment, I would submit, is precisely the opposite of dynamism. It is the art of treading water. It does not impel one to strike out for the far shore. Its product in American culture is mediocentrism, making out, being accepted in the organization. For when there is no mythic objective for which to strive—be it the objective of Horatio Alger or of the eleventh century man striving for heaven—all that remains is to look for the striking of a balanced posture.

The components of adjustment as an ideal, insofar as the ideal has found an American form, are subtle and not easy to delineate. At its center is the conception that the natural state of man is happiness, that where there is not happiness and its comforts, something is amiss. The second component is an equally subjective premise, one that sounds misleadingly Stoic. It is that acceptance of one's self and one's plight, an understanding of the roots of one's passions and torments, will achieve the state necessary for happiness. But the paradox is that while the doctrine seems to be tragic in its conception, its result must be judged against the criterion of happiness. If you have the usual material benefits and if you have recognized that your cravings are derivative of infan-

tilisms, then happiness should be your due. For reasons that are more than a little obscure, the stern and moral Sigmund Freud is taken as the quotable text for the conception.

The outgrowth of a cult of adjustment is inevitably realism, the palling realism that urges one not to make ridiculous demands. The measure is reality testing. If you are reaching for something beyond your grasp, you are either sick or you are ridiculous. So Americans risk becoming the most reasonable people in the world, in a world that is rife with unreasonable yearnings for mastery, for independence, for nationhood, for an end to other people's supremacy. It is a little like the story of the two caterpillars inching along. A butterfly flies overhead. One turns to the other and says: "You'll never catch me up in one of those things."

Our present static myth, I would urge, does not fit the challenge, the opportunities, or the dangers of our times. I would propose that what lies at the base of our difficulties in dealing with the great issues of world policy is that we have drifted into the position of believing that this myth of well-being *cum* happiness by adjustment is exportable, and that it is, when all hypocrisy is stripped away, the universal myth, whether of an urbanized Indian working in a new steel mill, a young African Negro contrasting his kraal with what he has seen of Johannesberg prosperity, an Indonesian peasant hemmed in on the island of Java by the most incredibly dense population per acre one can imagine to exist. There is, I think, a deep mistake here. This is not the prevailing view of those to whom in generosity and good sense we grant foreign aid. It is not the steady motive on which we can count in our diplomacy, not the consideration that leads Nassers to want Aswan High Dams, Sukarnos to proclaim paternalistic democracies, villagers in India to accept their hard lot. Nor is much illumined by the intermittent moralistic flashes that mark our foreign policy at most unexpected moments. To profess Christian revulsion against the use of force by the strong against the weak, even at the risk of shivering the Western Alliance—as in the Suez crisis—is admirable. But the moral power of the act is lost when it comes at the end of a period of playing economic tease with Nasser over Aswan—a game of tease premised on the idea that Egypt, like us, wanted just economic well-being and well-adjusted happiness.

The hard fact, the fact that is hard to swallow, is that those to whom we give do not want *us,* however much they would like our aid. They do not want the adjustmental realism that emanates from our position of strength. They are trying to break the shell of centuries of traditionalism or of colonial rule. They want unreasonable change; they want an appreciation of change; they even want a season of experimental irresponsibility to test the limits of their capacities. Our pattern of aid, however much it may in fact speed the development of underdeveloped areas, does not fit the hoped for pattern of expectancy amongst recipients, is not cut to the shape of their myths. They do not want our realism. There is loose in the world a nativistic cargo cult, waiting for the rich cargo to reach the island in a ship manned by the old gods, or if not old gods, certainly not white men. Can we respect the nature of such cravings, being reasonable?

What then must we take as the myths with which we shall have to cope in the modern world, the world in which we shall have to conduct our diplomacy in the coming decades? The question is vast and full of fatigue. Nor is it centrally relevant. Unquestionably there are only a finite number of idealized ways of life, ways of conceiving of the good life, and the philosopher Charles Morris has recently made a good start in trying to catalogue these in a manner at once empirical and mindful of the nature of philosophic values. What is most obvious, however, is that as communications become increasingly perfected and as men in distant places see what exists outside their valleys, there will be change. We conventionally speak of these changes as the growth of nationalism, but this is a political abstraction that may hide a deeper psychological fact. For when there is change, there is inevitably in each person who lives through it a searching for identity, for a myth of self and its relation to the society in which the self finds its meaning. There is also a sense of wonder, often fearful wonder about the processes of nature upon which man's destiny depends. And this is particularly true in an age of such vast technological innovation as ours when man is capable of releasing such huge energies from nature around him.

It is here that I must return to the theme with which I began. If we do not explore by creating new myths of the nature of man

and his place in nature, then we shall not understand and partake in the fullest spiritual sense in the change that the world is about to witness in ever accelerated form. But we cannot explore by such acts while the intellectual community is divided between the humanist and the scientist. For only by coming to terms with each other can they renew the activity that justifies their place in the society—the formation and transformation of myth.

Our chief antagonist in the struggle for spiritual mastery, the Communist states, do not have the flexibility to explore. Theirs is a formulated image, centrally controlled, infinitely dreary in its dogmatism. Yet it is one that during the first moments of protest against traditional ways is immensely appealing to the leaders and potential leaders of the new nationalisms of Africa and Asia. It gives a promise of sweeping away the old order justified by a myth of historical necessity and by a homily about the inevitability of breaking eggs (or heads) if you are to make an omelette. If the concepts of liberal democracy are to be viable in our time, they must provide an alternative to the image of sweeping away, of self-discipline and initiative which, in the phrase of Gabriel Almond, is the extrinsic appeal of communism to the uninitiated. We act, in our adjusted and realistic way, as if we feared change, feared new brooms, and new conceptions of society.

Let me, finally, explore the dimensions of this fear, this fear that breeds the spirit of exclusion that is the McCarran Act, that leads the humanist to turn his back on the "horrors of science," and the scientist to dismiss the efforts of the humanist as "just poetry." Partly it is the fear of the false optimist: we no longer believe in the inevitability of uniform and unilinear progress, yet we cannot rid ourselves of the notions that go with this once important myth. We have all, not just the physicists, known sin in our time—genocide, the dropping of atomic bombs that could kill tens of thousands at a time, the image of thermonuclear weapons worse by an order of magnitude. It is not comfortable under such circumstances to face ourselves anew—unless we do so in some absolute and easy way that proclaims either that *Angst* and absurdity are all—lest we be surprised by what we find and must get there first with the most horrible possible picture, or we decide that the problem is meaningless and that we should get on with the enterprise of adjusting realistically.

In the end, what have I to propose? What course of action seems the wisest? I cannot say, nor have I the competence of a statesman whose knowledge of means would be necessary for a proper answer. What I have to say is that we are not now in a position to propose an answer. Unless and until we are prepared to look squarely at the revolutionary challenge in creating conceptions of man and society and nature that fit the requirements of our time, unless we are prepared to examine alternate images of the meaning of change, we cannot succeed in formulating policy. For day-to-day dexterity in diplomacy or policy formulation is not enough. And here, in the end, is where the failure of the intellectual community to come to terms with the problems of man and his plight costs us most dearly. If our universities and intellectual centers are split, with men of the humanities calling for a cessation of disciplined wonder about the physical universe and the scientists fearful of the metaphoric method of the poet and the moralist, then where shall we find the questing myth makers who can take us beyond the ideal of adjustment? Our present myth of adjusted man—realism, security, comfort—seems to me massively unfitting in a world of unrealistic explosions, insecure polity, and sharp disparity in the distribution of goods in the world.

Freedom, in any proper definition of the term, has the implied meaning that it is a state in which prediction is difficult, where surprise is possible. Freedom in the intellectual community implies just that—that men will be free to create contending myths, to shock, to be one-sided, to savor the exploration of new possibilities. Our tremendous economic and political power, in principle, makes this possible in the same way that eccentricity is a prerogative of established families and the aristocracy. Our cultural power lies, I think, in our capacity to exploit this freedom, to give not only economic aid to the world, but to serve as a seed-bed for new conceptions, new myths, new possibilities. We have played that role in technology, are beginning to in science, and the American novel is supreme. What lies ahead as the challenge is to create from these the ferment of new myth-making. When we can come to appreciate the possibilities of change in myth, when we can exploit the degrees of freedom we ourselves own, then we shall be in a position to accept and cope with the changing world to which our policies must be fitted.

Two poems

LEE RICHARD HAYMAN

ALL THE PERIODICALS AGREE

Whether covered or bare the heads bend their
surrender to Sunday and paternal power
in air clean with innocence as hollow as
the hymns sung see-I'm-pure-ly or day-
dream counterpoint to sermon and our Book's
excerpts.

The voice drones, unnatural as sun-
shine filtered through a painted pane or human
madness or ladies' hair-do's—why not a sun-
bleached bone from Africa, sunflowers from Formosa?

Clever are the clothes and shines on unscuffed shoes;
lovely are the lawns around their symboled walls;
prosperity and peace walk arm-in-arm the aisles
of ribboned elegance—a perfect marriage
and the social triumph of our season, all
the periodicals agree.

From pews to news
hearts jump to eyes: their vista-vaulting,
overcome, commands reality again.

Only
a hint of make-believe humility hangs in the heart
precariously before full sunlight snaps the cord:
freedom to smirk and sin; freedom within.

SEGOVIA'S SEASON

Rain to the cobblestones and graves,
to the boulder bones of the Aqueduct
is remembered sweat of the Roman slaves
straining their lives for a water way.

Sun crusts the mold on broken walls,
on towers left where the servants toiled
and flashes the fountain where water falls
in a softer splash so the dogs won't wake.

Wind curls hems of the cafe cloths
ringing the Square of the Queen's own crown,
challenges wings of the summer moths
courting half-glows in the lanterned town.

Three poems

JUDSON JEROME

FOOTNOTE ON HEROISM

Greatness requires a kind of ignorance.
If someone follows a line, he has been hooked.
No one would carry a flag or take a stance
of valor if he knew how silly he looked.
Heroes would not be heroes if they were me,
or if they were quite all there up in the attic.
Oh, let me never single-minded be!
Belief in anything is psychosomatic.
Ideals are dangerous. A man possessed
may look good in the history books, but would
you like to have him here (improperly dressed)
in your living room? He likely would draw blood.
(His if not yours.) Don't let belief get started.
Like me, be open-minded, empty-hearted.

OH, LET ME FEAR

You say I am not guilty, only sick?
That Mother did not love me as she ought?
Her mother was in bourgeois morals caught?
That somehow economics failed to click?
You say that social forces move by laws
that far outweigh my puny little choice?
You say my words are echoes of a voice
which has a cause which has another cause?
You say I need not fear, may be assured
that if I cooperate I can be civil?
That modern brains are washable? The devil
can be cast out, my deviation cured?
Oh, let me fear, be wrong, be guilty; fill
my cup with poison—but give me back my will!

ABSOLUTE TRUTH

They say the atom is a kind of fiction
(and fiction, as we know, contains a blast).
that science only knows the right direction,
and tells us nothing certainly at last;
that reason is equipped for self-correcting
(it makes predictions, but no prophecy),
it is an instrument for close inspecting
(although it has no visions, it can see);
although it has no values, it can measure;
although it has no hopes, it can advance;
it can be used to calibrate a pleasure,
but looks on happiness as a romance.
It can explain, create, control and cure,
and blast. At last we will know truth for sure.

The impact of quantum mechanics

EDWARD U. CONDON

It is not easy to give you a view of what has been happening in theoretical physics in the past half-century at any time, but it is especially difficult after reading in the *New York Times* of June 26 about a poll among high school students that was conducted by Purdue University. This poll found that "high school students believe that a scientist is unable to have a normal family life, is more likely than other people to be mentally ill, is odd, has little regard for humanity, and is apt to be radical and unpatriotic."

Without claiming superiority for scientists, I would be the first to admit that they are somewhat different in their approach to things. They are extremely curious about how things work: they like to collect all the observational data they can, and to question and criticize the commonly accepted views about things. And they are constantly seeking new ways to understand familiar as well as unfamiliar matters—ways which they hope will prove more satisfying intellectually, because they relate rationally things not before recognized as being related at all.

They do not work at this approach to life, if by work you mean something hard and unpleasant. They play at it even when working the hardest, for to them the discovery of new truth and the destruction of old error is the keenest of pleasures.

This trait appears in some individuals when they are small children, often to the annoyance of those who express themselves in more poetic terms. For instance, when my older son, Paul, was six years old, he was at a tea party with his mother and listened to the conversation of a group of ladies, the subject of which was a current local case of love at first sight. "He looked at her, and she looked at him, and something passed between them," said the narrator, using a poetic imagery that surely you have all heard before.

"What *was* it?" piped young Paul eagerly, and I could see that

here was another young physicist who was already planning objective tests with Geiger counters and lead absorbing screens of various thicknesses in order to discover the properties of this powerful new interpersonal radiation.

Those people whose approach to life is so narrow that they have no room for anything but appreciation of the so-called humanities seem to think that physicists have no aesthetic sense. Actually their studies and special ways of understanding nature give them a heightened sense of appreciation that others deny themselves. While sitting one Sunday morning in church, I looked out of the window at the beauty of the sunlight on the leaves of the trees and some lilac bushes. Surely there is no person who does not react to the beauty of that. But in addition to the ordinary reactions of those who are not odd, my thought turned with great pleasure to recalling the beautiful studies made in 1902 by the Cambridge botanists, Brown and Escomb.

As you know, green leaves take in carbon dioxide from the air and, by the process known as photosynthesis, form it into carbohydrates. But there is not much CO_2 in the air, only about 0.03 percent, so diffusion of it into the leaf surface is a slow process. That is probably why the total leaf area of a plant needs to be as large as it is. Some botanists had maintained that to account for the actual rate of uptake of CO_2, this gas must be able to diffuse in through the entire area of the leaf. Others had insisted on anatomical grounds that the CO_2 could only enter through the tiny openings in the leaf surface that are called stomata, and which have a total surface area less than one percent of that of the whole leaf.

Brown and Escomb brilliantly settled the argument in favor of the stomata by a mathematical analysis which showed that the CO_2 can and does diffuse laterally along the leaf surface towards the nearest hole as it approaches the surface. The remarkable and, I insist, beautiful thing here is that the plant uses a feature of the mathematical laws of gaseous diffusion to get its CO_2 supply in through a tiny fraction of the total leaf area at nearly the same rate as if the entire area could absorb it.

When you fully understand a thing like that, then the sunlight on the leaves of the lilac bush is vastly more beautiful—just as a symphony can be a source of much deeper soul satisfaction to one

who has studied music than to one who is ignorant of it. So the next time you meet a scientist friend walking along smiling to himself, do not conclude that he is one of those who are more likely than other people to be mentally ill. He is probably enjoying the esoteric beauty of a world that only he and his kind are aware of.

These little stories are not entirely irrelevant to my intention to discuss quantum mechanics. They are not because I feel it to be essential to give you as vivid an image as I can of a physicist as one who has an intense desire to understand, in rational terms, the world in which we live, and as one who experiences genuinely ecstatic delight at the small successes that he and his colleagues have from time to time in this quest. To him it is only incidental that such understanding can often be used in various fields of technology, sometimes misused in ways that he deplores as much as anyone, a misuse that is especially painful to him when he finds himself being blamed for such misuse.

The distinction between the scientist and the engineer is a real and important one, for it is the latter who devote themselves to using results of science to advance technology. The Purdue poll found that even high school students understand that there is a distinction, for the Purdue report says, "The students think engineers are the bastions of our strength, but that the scientist is an incompetent radical."

But let's not kick the engineers around. We all enjoy good mass-produced food, textiles, housing, and sanitation, and besides, this is the year for lambasting our schools.

If now we really try to get down to business, let me remind you that at the beginning of this century we knew almost nothing about the atomic structure of matter and that now we know a great deal. In the nineteenth century atoms meant little more than a way of expressing the combining weight relations in chemical compounds. In its last decade, however, that century produced a wealth of new insights in atomic physics, with the discovery of electrons, of x-rays, and of the natural radioactive elements. These gave us vast new fields for experimentation and study and opened up the way for new technological developments, such as radio and television, the medical use of x-rays, and ultimately the use of uranium for atomic bombs and nuclear power.

It is easy to fill popular articles on physics with details of concrete things, which really are interesting and important, but I want instead to direct your attention more to a radical revolution in abstract ideas, of ways of thinking in physics, which has also occurred in the first half of the present century. I believe that this revolution will probably be at least as far-reaching in its consequences for human thought as the specific factual discoveries which gave rise to the theoretical developments.

Modern science began in the sixteenth and seventeenth centuries, with Copernicus, Kepler, Galileo providing the correct picture of the motions of the bodies of the solar system and the basic concepts of mechanics—initiating a program which culminated in the intellectual synthesis of Isaac Newton in which all this vast complexity was reduced to predictable order. In this scheme, bodies move exactly according to simple mathematical laws of motion in accordance with forces of attraction between them which vary exactly as the inverse square of the distances between them. Newton's *Principia* was published in 1687 and the intellectual world has never been the same since.

Mathematical astronomers spent the eighteenth century working out the further detailed consequences of the things taught in that book, having success after success in explaining detailed fine points about the motions of the moon, the earth, the other planets and their satellites. Even the crazy comets behaved as Newton said they should. There were no clouds on this horizon anywhere: all such motions were exact, determinate, calculable, precisely predictable—the universe was a giant well-oiled machine; no, not well-oiled, rather so exquisitely built as to need no oil.

When in mid-nineteenth century the outermost-known planet Uranus was found not to be moving exactly as predicted, Leverrier in France and Adams in England independently thought that this must mean that there was an undiscovered planet pulling on Uranus. They solved mathematically for where this hypothetical body would have to be to account for Uranus' erratic behavior. Galle of Berlin turned his telescope to look for it the night he received Leverrier's calculations, and there was Neptune just where Newtonian theory said it must be.

So successful was Newtonian mechanics with its exact causal interplay of forces producing fully determinate and predictable

motions that for many it became the unquestioned model for all of science. Biology and social science were under pressure to express their findings in language and pictures borrowed from Newtonian physics.

Dr. J. Bronowski, the British scientist, has characterized pre-1900 science as being marked by four unspoken preconceptions which affected and directed the scientific thought of that time. These were: (1) the principle that the chain of events is from cause to effect, a strict determinism, leaving no uncertainty in nature; (2) the principle that all science is quantitative, not merely that science does involve measuring and setting up precise relations between measurements, but that only that which is measurable and subject to exact discussion is truly scientific; (3) the principle of continuity, that nature moves smoothly from instant to instant, that although some things occur with great rapidity, they really unfold continuously if only we magnify the time-scale sufficiently; and (4) the principle of impersonality, that nature is a great machine going on imperturbably, which the human scientist can only observe, or to quote Bronowski: "The scientist did not invent, he saw. He did not use his imagination, but his observation. He did not create order among the natural phenomena; he humbly found it."

Especially with regard to this latter point does Bronowski feel that science in the nineteenth century cut itself off from kinship with the imaginative and creative arts: "Determinism, measurement, continuity and impersonality were parts of one vision: the vision of science as remote from life."

It seems to be a rather general characteristic of human behavior that we run to extremes. Perhaps in matters of intellectual advance that is a good procedure. Newtonian mechanics did have tremendous success in explaining motions of visible objects of all kinds. It accomplished a great deal with determinism, measurement, continuity and impersonality. It is natural and proper for science to try to exploit such a successful method to the utmost, because as long as a method is fruitful it should be worked. In that sense the dominating influence of deterministic mechanics on all science in the eighteenth and nineteenth centuries was natural and good.

It was wholly proper that the great French mathematical as-

tronomer Pierre Simon Laplace, should assert confidently, as he did in the early nineteenth century, that if we were given at this instant the whereabouts and speeds of every atom in the universe, then we should be able to forecast the future fate of the universe without the slightest uncertainty, and moreover we could reconstruct its entire past. In making such a claim he was accurately stating the kind of world which Newtonian mechanics implied.

In particular, deterministic mechanics, if it were a complete and ultimate theoretical foundation for the workings of the entire universe, would leave no room for human free will. In fact this consequence of it was often quoted as a "scientific proof" that human free will must be an illusion.

Our modern knowledge of atomic structure dates from 1913 when Ernest Rutherford gave experimental proof that most of the mass of each atom resides in a central core which he called its nucleus, and when Niels Bohr built a theoretical model on this idea which successfully correlated many observational facts about the emission and absorption of light by atoms. Forty-five years later, now, we are in possession of a vast amount of detailed knowledge about just how these atomic nuclei are put together, and how they disintegrate in radio-active change, and how the outer electrons are bound to the nuclei in different ways in different atoms that account for the specific chemical behavior of the different chemical elements.

We live now in what is called the atomic age. In many places in commercial art we can see conventionalized pictures of atoms, showing the central nucleus surrounded by various closed loops which are supposed to suggest the orbits of the whizzing electrons. Except for the idea of a central nucleus somehow surrounded by electrons, such pictures have been known for more than thirty years to be totally wrong and misleading. Yet they are a symbol of the atom which we all accept. We would no more think of changing these pictures than we would expect the little Victor terrier to recognize his master's voice when it comes from a modernistic hi-fi set.

For general discussions of physics, the usual emphasis on successes and specific factual agreements with observation is so great that the fact is seldom stressed how greatly Bohr's atom was in

conflict with the main ideas of nineteenth century physics. Let me state the case:

(1) He had electrons going around in orbits but not radiating light continuously. This contradicted not only theoretical electromagnetism but the known actual behavior of electric charges moving in commercial radio antennas.

(2) He violated the principle of continuity by asserting that the possible orbits were only certain discrete ones, and that other orbits as close to these as you please were impossible of occurrence in nature.

(3) He assumed that light is emitted and absorbed when electrons make abrupt transitions between orbits, not being emitted continuously as with radio waves, but emitted in little discrete bundles of light energy called photons or light quanta. This view proved to be exceedingly difficult to reconcile with well-established nineteenth century proofs of the wave nature of light.

(4) Finally, although he supposed light emission to occur by such abrupt jumps, he nevertheless used the mathematics of continuous wave emission from nineteenth century electromagnetic theory to calculate the relative intensity of different lines in the spectrum.

Out of this strange agglomeration of inconsistent ideas the modern theory of atomic structure was born. It was so successful in specific correlations of observational material that most of the physicists of the world rushed to play the new game of atomic physics as Bohr had invented it. Curiously enough, it was largely left to Bohr himself to be the severest critic of the foundations of his own theory, while others were uncritically exploiting it for new successes.

This situation persisted for almost a decade, but by 1924 the difficulties and inconsistencies of the initial formulation were blocking further progress. On some problems the Bohr theory was definitely giving wrong answers. It never succeeded for example in giving a clear picture of the nature of the chemical bond by which atoms join up to make molecules.

Physicists now had forced on their attention the fact that the Bohr theory was really teaching them that atomic particles do not move in accordance with Newtonian mechanics. Therefore, the most important fundamental problem confronting them was that

of discovering the new rules, which came to be called quantum mechanics, which do govern the dynamics of atomic systems.

As clues in the search for these new rules, two different ideas proved to be fruitful, among many which were explored and found to be worthless. The good ones are:

(1) The idea that the puzzling way in which light behaves in some respects as a wave motion, and in other respects as a stream of particles, is more general, and also applies to the behavior of material particles such as electrons and protons.

(2) The idea that, however different from classical mechanics the new quantum mechanics might be, the two theories must join on smoothly as we go from smaller to larger systems which are known to be correctly described by classical Newtonian mechanics.

Each approach was successful in leading to discovery of what at first appeared to be two rival theories of atomic mechanics, but which were soon discovered to be two different mathematical expressions of the same doctrine dressed in different mathematical clothing. The approach by generalizing the wave-particle duality to electrons and protons was that for which the names of Louis de Broglie of Paris and Erwin Schrödinger, then of Zurich, will always be remembered. The second approach, based on looking for the connection between quantum mechanics and classical mechanics as a limiting form, was that taken by Werner Heisenberg of Göttingen, aided by Max Born and Pascual Jordan, also of Göttingen, and Niels Bohr in Copenhagen.

At first (1925-27) our knowledge of the new quantum mechanics was hardly more than that of bare acquaintance with a new and difficult mathematical formalism, without much physical insight or understanding of its real significance. It involved, especially the Heisenberg formulation, mathematics that was quite unfamiliar to physicists at that time. To learn it was not fun, but hard work, yet its many successes in correlating physical phenomena were such as to convey overwhelming conviction that there was great truth in this strange structure.

When physical insight did come, largely through the work of Born, followed by Heisenberg and Bohr, it was so revolutionary in its implications that it was completely unacceptable to many. Einstein, in particular, by far the greatest physicist of our times, never fully accepted the theory as a fundamental advance. He

conceded that as a mathematical formalism it worked very well, but the basic interpretation which physicists have now acccepted for the past thirty years he always regarded as a temporary makeshift representing present ignorance.

As you know, and as I am about to say in more detail, the interpretation represents the giving up of strict causal determinism and replacing it by a statistical indeterminancy. Einstein's reaction has often been quoted: "Der liebe Gott würfelt nicht!" or expressed in western mining camp parlance, "The good Lord doesn't shoot craps!" For the last quarter century of his life Einstein devoted much of his thought to trying to support this thesis, but without success.

I had the good fortune to be in Göttingen, Copenhagen, and Munich during 1926-27 as a young fellow who had just received his doctorate in Berkeley. It was exciting, but it was also very difficult. Believing that that hectic year was the normal pace of theoretical physics, I personally became so discouraged that I took a public relations job with the telephone company in New York on coming back to America. But I soon found that there was just as much confusion and difficulty being experienced in the universities as any that I felt. Feeling therefore that I could make a contribution to this chaos, I took a job at Columbia University and began to lecture on quantum mechanics.

Perhaps the most vivid impression I can give you of the upset state of the minds of most physicists at that time is to quote a remark made by beloved old Professor Bergen Davis of Columbia, who died last week at the age of eighty-nine. I have called his the conspiracy interpretation of quantum mechanics, for he said, "I don't believe you young fellows understand it any better than I do, but you all stick together and say the same thing!"

De Broglie and Schrödinger had developed a formal mathematical wave theory, but it remained for Born in 1926 to interpret the intensity of the wave in a statistical or probabilistic way. With his interpretation it is a characteristic feature of quantum mechanics not to make fully deterministic predictions of what will certainly happen in atomic systems. What the theory does instead is to describe the several possible alternative outcomes of an experiment and make predictions of the relative probability of them, that is, the relative frequency of occurrence of them in many trials.

Which outcome actually occurs in a single trial is fundamentally a matter of chance, entirely indeterminate.

The way in which this theory joins on smoothly with deterministic classical mechanics is this: As the system under consideration gets larger and larger, a particular kind of behavior becomes overwhelmingly more probable relative to the other possible behaviors, so that in human experience it is practically the only one that will be observed. And this overwhelmingly most probable one among several is exactly the one which is described by the old deterministic mechanics of Newton.

In 1927 Heisenberg and Bohr published fundamental ideas on the reason why atomic physics must have such a statistically indeterminate character. The basic reason is that it is impossible wholly to separate the observer from the thing observed. The act of observing a system necessarily introduces uncontrollable alterations in it which interfere with the possibility of making precise predictions about its future behavior. This result in a mathematically more precise form became known as the Heisenberg uncertainty principle.

A century earlier, Laplace exulted that the whole future and past could be worked out by Newtonian principles if we knew the present position and speed of every particle in the universe. Heisenberg showed why to do this is not merely difficult, but fundamentally impossible, because of the impossibility of making the observations needed to produce what Laplace required.

It is true that when you look at the moon, or even at a ping pong ball, the light which is scattered by either of these objects into your eye which lets you see the motion has a negligible effect on that motion. But Heisenberg and Bohr could show that if one tries to plan analogous ways in which the motion of an electron along a path might be similarly observed, that such effects are not negligible. With an electron the particle is so tiny that the light which must be scattered from it in order for it to be seen produces uncontrollable recoils of relatively large amount. Hence the mere act of observing the electron's motion introduces statistical uncertainties about what that motion will be.

In 1928 quantum mechanics provided the basic explanation of the radioactivity of uranium and radium. Here the statistical character of the basic theory is the essential thing. For many years

we had known that uranium undergoes spontaneous decay by ejecting a high speed alpha particle. In a given time interval no known change such as temperature or pressure or state of chemical combination alters the fraction of them which will blow up in the next minute. Some will blow up in the next minute, others will not do so for billions of years, and we have no way of knowing which particular one will blow up when.

Quantum mechanics explains it this way. When inside the uranium nucleus, the alpha particle is held in by attractive forces. When outside, it is repelled from the nucleus by electrical forces. The uranium nucleus is thus surrounded by a force barrier like the mountains which separate the western slope from the eastern slope here in Colorado. The alpha particle does not have energy enough to go over the barrier. Therefore, according to strictly deterministic classical mechanics, it certainly will never do so. If inside the uranium nucleus, it is constrained to remain there forever, that is, unless the uranium nucleus is broken up by some drastic outside action.

But according to quantum mechanics it is merely unlikely that it will leak through such a barrier, but not impossible; in fact it has a small and mathematically calculable chance of leaking through such a barrier in each time interval. The very existence of radio-activity is thus explained in terms of this not fully determinate nature of quantum theory. The remarkable thing is that we can calculate the rate of leakage from fundamental principles and find that it agrees with observation for a variety of radioactive isotopes that disintegrate in this way.

Incidentally, this particular application of quantum mechanics was discovered independently in the fall of 1928 by George Gamow, a young Russian physicist then in Göttingen, and by Ronald Gurney and myself, when we were together in Princeton. Gamow is now a professor of physics at the University of Colorado, where I had the honor of being a summer guest. These personal facts and the fact that so much of the state's mineral wealth is now in uranium give Colorado quite a stake in the Heisenberg uncertainty principle!

In thinking about the distinction between classical mechanics and quantum mechanics it is essential to keep quantitative factors

clearly in mind. In principle any mass may leak through any mountainous barrier in quantum mechanics, whereas Newtonian mechanics says it cannot do so at all. Thus in principle, a Denver and Rio Grande train might leak through the Rockies without the Moffat Tunnel being there. But in a uranium nucleus, the alpha particle pushes against its barrier about 10^{21} times a second, and yet on the average requires two billion years of trying before it leaks through its little atomic mountain. Hence as a matter of fact it is better railroading to build the tunnel, aside from the statistically indeterminate character of the railroad schedule involved. The case of radio-activity is just one of many that might be used to illustrate the distinction with regard to determinacy between classical and quantum mechanics.

All work in atomic and nuclear physics in the past thirty years, during which spectacular advances of detailed knowledge have been made and applications have even included making hydrogen bombs for Christian statesmen to brandish at the brink—all these things have been done with the use of this kind of statistical theory rather than with the old deterministic methods of Newton. It is not correct to say that Newtonian theory has been thrown overboard. It is still fully valid for ping pong balls, railroads, the moon, and such. But now we are aware of the limits of its validity, and in many areas we know quite exactly what mathematical methods are to be used outside of those limits.

Now my own view is that it was never correct for people to believe that Newtonian physics was the one true faith to which all science must be molded. That viewpoint, which certainly did strongly dictate the methods of biological and social science in the nineteenth century, never was anything but at best a working hypothesis, and at worst an unwarranted extrapolation of incompletely known physics. Therefore if such ideas still exert any dictation on the other sciences, they ought to be cast aside as improper and unfounded. If any doubts about this remain, they should be cast aside because the physicists themselves have found boundaries to the validity of Newtonian principles within their own science. Therefore, certainly these ideas do not have any a priori claim to validity elsewhere.

As for human free will, that can no longer be ruled out simply by an argument based on the supposed universal validity of the

absolute determinism of Newtonian mechanics. That illusion, if it be an illusion, I feel so strongly that I am freely deciding right now to end this article here.

A NOTE ON LIBRARY POLICY

By Larry Rubin

We should never have opened the stacks to the undergraduates.
It's become their favorite trysting place. Like crafty Abelards,
They hide their fingers underneath their books
And pluck at Héloïse.
They swarm; they kiss in cubicles; for all we know
They breed down there in the twelfth century.
(That's where the bulbs are broken; the stack boys
Have to use flashlights on that level.
But they never report anything amiss—
Sworn to secrecy, probably.)
It's most distracting.
How is one to annotate his bibliography
When everywhere he finds these naked couples
Hiding deep in depthless carrels?

I know. They try to be quiet.
But every now and then a girl will laugh;
Warm and moist,
The sound floats up between the cracks of the neoclassic shelves,
And when one is trying to correlate variant versions—
Well, really.

SNOW ON TREES

By James L. Montague

The fall of half a night of fluffy snow
Is balanced on the trees just as it fell,
Each flake so lightly set on each below
A breath should be enough to break the spell.

Birds will be first to clear the heaped up branches
When they awake within the layer of white,
Start snowslides turning into avalanches
By shifting perch or stirring air from flight.

Wind will sweep clouds of it away in dust
Fling lumps that flying burst (without a sound)
To smoke puffs, shake tree frameworks with a gust
To jettison whole boughloads to the ground.

Not that the trees could ever hope to hold
To what they intercepted on its way
To earth. They can no more sustain this load
Than leaves or blossoms of another day.

A birthday present

ANNE SAYRE

Marr-Hawken was not a good school. It had clung stubbornly to life for almost twenty-five years (Julius Marr was already planning the anniversary celebration, the special advertisement in the Schools and Colleges section of several magazines) without either succeeding or failing in the financial sense, which was to say that it maintained year after year an enrollment never large enough to make it prosper and never small enough really to justify giving up. This characteristic was the determining one, and accounted for the rest—the erratic, shifting, dispirited staff, the meanness of the meals, the film of bad housekeeping which clung to all its rooms, the pervasive smell of dry-rot in the buildings, the weediness of the lawn, the inadequacy of the equipment, the dilapidation of the books in the dozen or so shelves which composed the library. Possibly it even affected nature in its grander designs: the old trees which shadowed the grounds and which buried the lawn periodically with unraked leaves had the gnarled and tottery appearance of old men, the ivy which was silently tearing the chimneys brick from brick appeared diseased for all its tenacity, the apples which dropped from the stunted trees in the orchard were hollow with worms, the birds which nested under the eaves were shabby and starveling. But miraculously, Marr-Hawken persisted, carried along by the ghost of a recollected idea, by the persuasiveness of the brochure, and by the simple fact that a number of people possessed daughters of whom they wished to disembarrass themselves: the students, like the staff, were a dejected group, exuding unhappiness. Marr-Hawken possessed every fault possible to a school except cynicism—once, at least, it had meant well.

The students had a peculiar unity which went beyond the fact that they were all girls and all somewhere between the ages of twelve and seventeen. Some were pretty and some were not, some were healthy and some were frail, some were equipped with rudimentary attractiveness and many were charmless beyond all re-

claiming, but all shared a faint air of tragedy. This was not accidental. Marr-Hawken specialized in sheltering girls upon whom some blight had fallen. The arrival of a new student was always the occasion for Virginia Hawken to move among the older girls murmuring in her hushed, funereal voice that everyone must be very kind to little Mary Jane Wilkins, for she had just lost her mother, or her father, or possibly both parents, and usually in some peculiarly catastrophic fashion. Orphans, semi-orphans, girls protected but not precisely cherished by guardians, girls too difficult or too dismal for home consumption, or representing too much in the way of baggage for a peripatetic family (two of the girls, for instance, had fathers in the minor diplomatic service), and, all too often, girls with a parent in an institution for alcoholics or in the care of a psychoanalyst, were all deposited at Marr-Hawken. They could be prepared, the brochure said, for any college, and would be provided with a rich cultural background while living in the healthful and home-like surroundings of a private estate in New Hampshire, and for all of this, the fee was modest. Especially attractive to the parents and guardians of girls on deposit at Marr-Hawken was the promise cheerfully made that the students could be taken care of during holidays; you could barely tell when summer came, so few of the girls seemed to have homes to go to.

It was a sad and not at all a good school, and about this Helen Custer had not deceived herself. Its very unlikeliness had made it appear from the beginning exactly what she wanted, which was a refuge, and indeed, its very inadequacy as a school had served to open its doors to her. A better school would not have considered her for a job, much less snapped her up, and the feeling that she had been sought out, by however shabby an organization, had given to her first six months at Marr-Hawken a peculiar, comfortable glamor. And it was peaceful. She liked walking around the grounds so overgrown that there were reaches of shrubbery as dense and enfolding as a forest, and reminding herself that she was relaxed and unchallenged and at last free to breathe. She wrote of it glowingly to Norman. Had it not been for Norman, she would not have been at Marr-Hawken; it was Norman from whom, of course, she was taking refuge. Three years of living with Norman had reduced her to physical and emotional penury;

the sight of her face, still scarred with weariness and past desperation, never failed to surprise and horrify her when she saw it in a mirror. Loving Norman had eaten into her youth like acid.

A richer woman, Helen had told herself, could have indulged in a rest cure, a tour around the world, or could have gone to an analyst; looking out of her little window under the eaves of Mary Braithwaite Marr Hall (which was only the east wing of the house) at the forlornness of the apple orchard, she would think ironically that this was her substitute, her therapy, her rest. In return for a very small salary, she directed admissions—she had once been secretary to the personnel manager of a large department store. She also taught two courses in English, put together from dim recollections of her college days. All the faculty at Marr-Hawken held double, if not triple, appointments; the work was hard. And the cure, for Helen, was effective. The third week of her residence in Mary Braithwaite Marr Hall, she had thrown (late at night, and from her high narrow window) an almost-full fifth of rye down to the rocky lawn below. She had heard the bottle break, and had gone down very early the next morning to collect the fragments and bury them in the deep leaf-mold under the densest shrubbery. This ritual burial had been exactly like burying the dead weight of the past.

The next step in her cure, as Helen had come to visualize it, was to pass an entire day without thinking of Norman. This she had not quite achieved, but she had moments, and even entire hours, of thinking of him dispassionately, without beginning to quiver, or to have hot meaningless tears gather under her eyelashes. She succeeded, as the weeks went by and the peculiarly bleak autumn atmosphere of the school turned into an unusually grey and frigid winter, in reading his letters—frequent, but always brief and reproachful—without being reduced to despair. Norman, and the whole matter of life with Norman, had not faded but had somehow receded into a crystalline distance at which they could be observed in clear and minute detail but—miraculously—not felt. It was precisely what she had hoped for: the power to see it all and at last to think.

By Christmas time, Helen had begun to feel almost recreated; writing of it to Norman, she made it seem casual, as if she had done no more than recover from some trying but temporary ail-

ment which had not been of great importance. Privately, she cherished the feeling, magnified it, tested it out in a dozen minute ways. "This time last year," she would say to herself, staring out of her office window over a pile of promotional letters which she was supposed to be signing, "this time last year we quarrelled over Christmas presents, we went to that party, and Norman went home with Martha Quigley. I had a cold in my head and he said I looked like a naked little pig ready for roasting." She spent hours recalling, digging up all the past pains and pinpricks; she would clutch her elbows, crossing her arms tightly over her stomach, and marvel at the accuracy of her memory and the strength of her recovery which made all this recollection painlessly possible. She felt terribly strong.

He wrote, "Will you be in New York for Christmas?" and she wrote back calmly and rather teasingly that she would not. She looked forward to the peace of Christmas at school, where there would be nearly a full complement of pupils, who had nowhere else to go, and of teachers, who could not afford to go anywhere. There would be no drinking, no quarrelling, only the heavenly peace. There were several parties with games, and warm sweet cider spiced with cloves and cinnamon was served in the bleak sitting room of Archer Hall (the west wing) and a Christmas tree cut from the evergreen shrubbery was erected in the Students' Room, where it died under its strings of popcorn and paper chains in a rich, nostalgic odor of pine. Norman did not send her a present, and because of this she cried for all one night—she thought of it as a relapse. She had ordered by mail for him a set of Bach records, a cashmere sweater which she could not afford (but he took cold easily, never dressed warmly enough), and half a dozen pairs of the sort of socks he liked. On New Year's Eve she had, however, a long telegram from him; she was reasonably sure he had sent it when drunk. But by then her sense of clarity and proportion had returned, and she did not weep at all. She felt amused, and just a little touched.

Trained by twenty-four Christmases of almost desperate bleakness, Virginia Hawken and Julius Marr had devised an enormously full, dull program for the holiday week. Helen led packs of girls, like so many dispirited hounds, on long hikes across the frozen hills, and in the evenings, prepared clues for a treasure

hunt. As the staff sat at the long dining-hall tables, turning crepe paper into costumes for the New Year's Eve masquerade, Julius sat and spoke in his slow, ponderous, professorial voice of the philosophy behind the school, and the viewpoint he expressed seemed inspiring to Helen. The other teachers had possibly heard it too often and had contrasted it too sharply with actuality, but Helen felt as she listened that her life had at last fallen by some wonderful accident into the shape of purpose. She wrote to Norman that night of the good she was doing in sharing in a program for training young girls in the classic disciplines which had been for too long confined to the education of boys; "I should like to stay here forever," she wrote, "and die in harness." It was the first time she had ever challenged him so definitely, and she waited eagerly for his response; it came weeks later, shakily typed in caustic phrases (she saw he must be drinking again), but she was less pained and shocked than she had expected. For by then, she was thinking of the spring.

She did not know when it had occurred to her, perhaps on the day after the holidays were over when she discovered a holly tree buried in the shrubbery and noticed, with piercing delight, the bravery of the shining leaves and the bright red berries gleaming against the dull grey sky. She scratched her hands breaking off twigs of holly to put in her room, and impulsively enclosed a sprig in a box and mailed it to Norman. In the diary which she had begun to keep now that her days were so much alike and there was nothing painful to write of, she pinned a holly leaf to the page and wrote, "If I had to choose a symbol, I think I would pick holly—thorny but brave, growing in dark places and thriving when all other things are dark and fruitless, beautiful in a durable way. Dr. Marr says the crocuses will come soon, and they have a value too—pushing up through the hard ground and the snow with fragile, determined little spears. They both make the best of hard times." The same impluse which had led her to send the holly sprig to Norman made her copy these sentences and send them to him as a letter—almost, she thought, as a poem.

A week later his reply came, and she carried it out into the cold wind to read, holding the flapping pages between her mittened hands. The letter sounded querulous; when, it demanded, was she coming back? She shivered, but she was warm—this, of course,

was the thing for which she had sacrificed everything and disciplined herself so hardly. She was flooded with a series of spring-like visions: the apartment on Perry Street encompassing, for once, harmony and peace, with everything subtly changed, with old quarrels buried and forgotten. She saw herself clearly, greeting Norman at the door, holding out her arms with warmth and tenderness, and she understood that she was embracing him as he came home in the evening. She remembered with a faint shock that it had never been so. When she had dragged herself home from work in the crowded subway, buying groceries on the way, it was Norman who had always opened the door to her, and she passed under his scowl into the little room filled with cigarette smoke and the crumpled wads of paper which testified to the inadequacy of that day's inspiration. "Did it go well?" she would ask, timidly, and he would say, "Rotten." The wads of paper were supposed to be the pages of a novel, but she had come to see them as tombstones commemorating the death of a thousand hopes. Often as not before she had her coat hung in the closet they would be quarrelling, and she would be weeping; "How your face swells when you cry," Norman would say, critically, "like pink dough." She would have to take two or three drinks from the bottle of rye in the kitchen, surreptitiously, simply in order to relax her nerves, and then another quarrel would begin.

But the new vision, so different, so swift and convincing, held her transfixed with its beauty and promise. All her striving had been to enable her to see this, to pass beyond the morass of twitching nervous pain to a new conviction; next, Helen thought, he would ask her to marry him. She folded the letter tremulously and put it into her pocket. He had written to her at last not as if she were an incubus, a dragging responsibility with which he was, against his wish and will, forever charged (and this she had never been able to understand, for it was her job, her apartment), but as if he wanted her back. Back home. Helen half-closed her eyes and laughed, and the thin sound was whipped away by the wind. This was better than the lifeless peace she had enjoyed in the autumn. This was promise. Convalescence was over; life, she thought, was ready to begin. But she would be cunning. She would not run back to New York. Oh, no! Smiling in a secret crescent of confidence, she planned; her letters, sucking cheer from the

cheerlessness of Marr-Hawken School, would proclaim her coy independence, would spur him on. She would return, but wooed and cajoled, ready to be tender to his humility. She put her mittened hand in her pocket to touch the letter and seemed to feel it warm through the grey wool across her fingers. Singing, she ran back indoors.

"Now, why do you sing, Miss Custer?" Julius Marr asked, passing her in the hallway.

She turned her face to him glowingly. "I'm just happy."

Julius shot her a look of astonished gratitude. "Just what we like to hear," he rumbled. "Happy teachers make happy pupils. The object of Marr-Hawken—in addition to the inculcation of the sound principles of a thorough classical education—is the creation of a happy, stable atmosphere around our pupils, many of whom are," he added, sadly, without the rumble, "unfortunate. I congratulate you, Miss Custer."

Afterwards, Helen noticed, Julius watched her; happiness, they said, made women beautiful. At dinner, as she sat at his table between Mademoiselle Tonnier, who taught what French she could recollect after forty-five years away from her native Marseilles, and Miss Huber, who regrettably suffered from an alarmingly intense facial tic, Helen could feel Julius's astonished regard of her swelling, visible happiness. She was ready to sing. Once, she thought, she would have had no desire beyond writing to Norman in an ecstasy of defiant self-justification, to boast of her contentment and prove beyond a doubt that his accusations (neurotic, he had said, incapable of satisfaction, fated to create an atmosphere and a world of clinging, desperate depression) were false and foolish. Security, which she was supposed to lack ("It comes from within, for God's sake," Norman had said. "Do you want me to tear out my liver for you to feed on?"), enwrapped her as warmly and richly as a good fur coat. She was strong; she could exude her happiness across the table which displayed turnips and brown, shreddy meat, and override the peppermint-scented grumblings of Mademoiselle, who lacked teeth, and the stammerings of Miss Huber, who lacked coordination.

Transformed with triumph, she wrote in her diary, "I have conquered life. I have won."

It was the rule at Marr-Hawken that girls did not receive birth-

day presents from home. The rule was conceived in kindness, for too many of the girls seemed to have no one from whom to receive presents while others, less accountably, never received any anyway. Parents and guardians seemed to welcome the rule, and to calm the girls' resentment, Julius and Virginia had devised a soothing ritual. Each girl's birthday was commemorated with a cake, a far-too-small cake which portioned out in scanty slivers, but which was consolingly iced in bright, unnatural pink. When the cook had time, the girl's name might appear in white frosting. To show the girls the value of the cake, the birthdays of staff members were identically celebrated.

It had not occurred to Helen to look forward to her birthday, which had gone for years uncelebrated, but she was reminded of it by a flash of peculiar, ecstatic insight. It happened quite simply. By then it was spring; on her desk Helen was keeping spring flowers gathered from the neglected but hardy flower-beds of the grounds. She began by picking a few snowdrops, and the sight of them stuck in a water-glass on the corner of Helen's desk moved a girl named Ida Chieftain almost to tears. Ida was a special pupil in English, which meant that she was too slow to keep up even with the slow class and had to be tutored privately twice a week by Helen. She would sit, like a dumb patient dog, panting over the parsing of a simple declarative sentence and from time to time lifting her eyes adoringly to Helen. Helen had been chosen as the recipient of Ida's affection, which was the unsubtle, exasperating, stupid love of a devoted hound; it involved on occasion clumsy and inappropriate acts of worship like the wagging of a figurative tail, which sometimes touched Helen and which sometimes infuriated her. The snowdrops were almost more than Ida could bear. "Oh, they're so pretty, Miss Custer," Ida said, in her husky, uncertain voice. "Don't you think flowers are prettier than anything?"

Helen smiled; Ida, in admiring a bed of flowers, would no doubt trample it under her clumsy feet. "If you like flowers so much, Ida," Helen said, "you may come with me to pick some this afternoon." She let her hand rest for a moment on Ida's tan-colored braids, wound around her head like pieces of rope; the girl quivered with delight, and Helen snatched her hand away. She had quivered for Norman, and she hated the reminiscent feel-

ing of the naked, delighted nerves. But the girl's love pleased her all the same; she enjoyed the afternoon walk, leading Ida from grape hyacinth to skimpy twig of forsythia to a clump of brave, shivering early violets, and she filled the girl's hands with flowers, feeling rich and generous.

"Oh, Miss Custer," Ida whimpered, in delight. "For me? Today is my birthday, and this is just like having a birthday present."

"Is it? Then happy birthday, Ida," Helen said. "But you should have a real present." She hunted through her coat pockets; in one there was an unused handkerchief, initialled "C" in pink embroidery. "You see," Helen pointed out, "that's for Chieftain."

"Oh, Miss Custer! Really for me? Tears hung on Ida's short pale eyelashes. "Can I show anyone?"

"Better not. It can be our secret," Helen said, and smiled. "A secret birthday present. That's the most exciting kind."

"Oh, yes," Ida said, "I guess it is. And I get a cake too, Miss Custer. You'll get a cake on your birthday too. And maybe I could give you a present—I can make penwipers."

"I should love a penwiper," Helen said. "My birthday is in two weeks exactly."

"Two weeks?" Ida calculated the time with her eyes closed. "But you'll get a whole lot of real presents too, won't you."

"Not a lot." Helen shook her head. "Perhaps one."

"A secret one too?"

"Perhaps." And then she nodded with sudden conviction. She understood all at once that that was, of course, what was going to happen. She had had two more letters from Norman, both uneasy and worried; he spoke of coming to see her if she did not come to New York. Now she knew that he was coming on her birthday. He could not forget the date, because by a coincidence which she had sometimes regarded as miraculous and sometimes as fatal, his own birthday fell on the same date; they were, to a matter of hours, an identical age. She stared off past Ida, her lips smiling proudly. On her birthday, spring would be at its riotous height, transforming even the reluctant foliage of Marr-Hawken School into apple blossom, into blood-red and paper-pink laurel, into bunchy clusters of bridal wreath and splashes of rhododendron. Norman would come borne on his anxiety and desire; he would

prevail upon her—not too easily—and against all the protests of Julian Marr, who would be left without an elementary English teacher, she would be carried off to Perry Street. She would be, Helen knew, submissive to his insistence, but also proud. Her pride would remain the shield against pain—to his humbleness she would show generosity he had never showed in the time of hers, and he would be forced into admiration as well as love. It was all quite plain.

"You look so beautiful," Ida said, sighing. And as they returned to the school, Julius Marr encountered them at the door and smiled in surprised approval at the sight of a teacher actually extending kindness to a pupil.

"You look as if you've been to a party," he said, to Helen, while patting Ida in a fatherly way. "Was it pleasant?"

"We picked flowers," Ida said, but Helen laughed.

"A joke?" asked Julius.

"I'm simply happy," Helen said. "Is that so strange?"

"Ah—it's the riddle of the ages," Julius said, sighing. "The riddle of the smile of the sphinx. An elusive bird, happiness."

"No," Helen said, gently. "It has been wonderful for me to be here."

This statement had never before, in Julius' experience, issued from the lips of a teacher; he knew too well, and in exact detail, the nature of their frequent complaints—the low pay, the bad food, the miserable rooms, the isolation of the tiny village, the chill, the dreariness, the abominable pupils, the lack of vacations. He was struck into silence, and, excusing himself, padded away, for this he would have to tell to Virginia. Helen's voice, raised a note, pursued him. "I just want you to know," she called, "that I shall always be so very grateful." As he looked back at her, thunderstruck, she felt a little tolerant pity—it was unfair, to be leaving on such short notice. But it could not, of course, be helped.

Helen charted off the days to her birthday; spring thickened around the school, whose drabness was not immune to warmth and light. She would be thirty-seven, she remembered, but the years no longer dismayed her; to be loved, protected and cherished one did not need the tireless strength and resiliency of youth. There was one more letter from Norman, short, but threatening almost harshly to come to see her. She did not trouble to answer

it. Freed from the necessity of pleading or of proving her strength, there was nothing about which to write; she was flooded by serenity, and the days were winged.

The day of her birthday came bright and clear, as she had anticipated. She knew the hours of the two trains a day which reached the village, and had long since decided that the first one would not bring Norman. Not for anything would he take a train which left New York at seven in the morning. The second train would bring him—or, of course, he might take a bus. But she swept aside these considerations; in any case, he would come by five o'clock in the afternoon. He would walk from the village. She would meet him somewhere on the grounds, casually, half-feigning surprise and half-permitting her foreknowledge of his coming to display itself. Having never seen her confident, Norman would be, like Julius, thunderstruck. They could spend the night, Helen calculated, at the inn in the village. Or perhaps not. The obvious objections to this plan struck her suddenly as comic; she giggled. No, a final gesture of respectability was owed to the school; very probably, anyway, the people at the inn, who knew her by sight, would refuse them a room. They would return respectably on the morning train—Virginia, she supposed, would weep.

The day inched by. She had no desire to hurry it; she was putting off, lazily, the enjoyable act of opening a present or indulging in a treat. At three o'clock in the afternoon, she put on her hat and her gloves and her spring coat; the grounds were deserted except for a straggle of girls coming back from the rocky meadow on which they played, without much enthusiasm, regulation games of field hockey. Already the shadows were long—the northern sky held winter late. Under Helen's feet the grass was damp and cold, and she had put on her best shoes; her wanderings were not comfortable. Earlier than she had intended she took up her station at the gate which had a view of the road which led down to the village. Norman would come up the road, and when she saw him coming she could hastily resume her pose of casualness—wander off towards the shrubbery, or pretend to be picking laurel from the bushes near the gate. She shifted her weight from foot to foot for a while, uncomfortably—the train was in, she knew, and he ought to be coming. But he was a slow, dreamy walker,

and he wouldn't (damn him, she thought) trouble to hurry for anything.

She managed another turn around the grounds, but she kept looking at her watch. She sat on a damp bench huddled in her coat, tucking her feet close together for warmth. Of course he was coming, she thought, his letters had virtually promised—or threatened—as much. Her confidence tarnished with the dimming light but remained stubborn; I connot be wrong, she thought, I *cannot*. It was well past five o'clock when the rain began to fall in thin springlike splatters, and it would not do, she knew, to be sitting and waiting in the rain. She had stood too often on rainy streetcorners where he had forgotten to meet her, in the lobbies of theaters to which he had come too late, on a bench in Washington Square which he had neglected to remember, and all of that belonged to the past. He would come, but he would have to seek her out; he might be irritable with the journey and the rain. She stood up and began to walk stiffly back to the house.

"You have been out in the rain," Julius said, from his post before the feeble fire in the Staff Members' Room. "You will catch cold."

"I needed a breath of air," Helen said. "The spring—"

"It can be oppressive," Julius agreed. "I have noticed. Sometimes I think some of the flowers and bushes should be rooted out."

"Perhaps," Helen said, but her head had begun to ache. She sat in the Staff Members' Room, forgetting to remove her hat and coat; to go up to her own room was impossible—no, she corrected herself, silly, for she would have to come down again so soon. The dinner bell rang through the house with its thin insistent clatter.

"Dinner, Miss Custer," Julius said, remindingly.

"I don't think I want any," Helen said. "I—I shall probably go down to the inn later."

"Oh, but you must!" Julius winked broadly. "This is—an occasion. We can't have you running off."

"Oh, but—" Helen began. And then she thought, let him come and see how happy and indifferent I am. She took off her hat and coat and followed Julius into the dining hall. The dinner seemed unusually bad—was it always so bad, she wondered, or had she not

been noticing, thinking of other things? Mademoiselle smelled too strongly of peppermint; Miss Huber's face danced a horrible rapid minuet of twitches. There were gravy stains plainly down Julius's vest. She had a sudden intense wish that Norman not come until dinner was over, that he should not see the gravy stains or Miss Huber's tic or have a whiff of Mademoiselle.

She had forgotten the ritual. The sound of singing broke out around her before she had noticed the cake being carried from the kitchen on a tin tray disguised with crepe paper; "Happy birthday to you," everyone was shouting, and then, "Stand up, stand up, stand up, Miss Custer, stand up, stand up!" *Me?* thought Helen, blankly. The cake was set before her; among half a dozen candles, she saw the words *Miss Custer* written across pink sugar in icing the color of aged copper.

"Happy birthday," Ida Chieftain was whispering damply into her ear; having broken all the rules about leaving her place in the dining room and about presenting gifts to teachers, Ida had scuttled across the floor and had dropped next to Helen's plate a scrap of flannel tied in a fold with a shoestring and painfully embroidered in cross-stitch with a staggering C. "I love you, Miss Custer," Ida said, and scuttled back across the floor before a storm of official wrath could break.

"Speech," said Julius, "speech."

"I can't," Helen said; there were tears running down her face. Julius leaned forward and sympathetically patted her hand. The candles were pooling wax on the cake and Miss Huber, unable to bear seeing the icing ruined, popped her head down and blew them all out. Then she sat back blushing and twitching and muttering an apology.

"It's quite all right," Julius was saying. "I see you're a bit overcome. Perhaps you didn't realize what a genuine family we all are here together at Marr-Hawken."

"I'm sorry," Helen said. The tears ran bitterly into her mouth. Mademoiselle, overcome with greed, had begun to slice up the cake on her behalf. The tears were blinding and choking, welling up from some great source of pain; "Excuse me," Helen said, and pushed back her chair and ran out of the room.

She went out the front door; the rain was falling heavily, and struck coldly through the hot tears on her face. He wasn't com-

ing, of course, Helen thought; she had always known he was not coming. The letters had promised nothing, had spoken of nothing but his occasional querulousness at the inconvenience of her absence. If he ever came it would be only to carry on the old quarrel—there was, she knew, no possible happy change for them. There was not even any going back. There was nothing but Marr-Hawken, nothing but Julius and Virginia, Miss Huber, Mademoiselle, Ida Chieftain, the bad food, the dismal atmosphere, the clinging odor of failure. She had resisted this certainty, this fact, but it had to come; there was nothing else. She pressed her hands flat against her thighs in a silent agony, turning her face up to the rain. I am here forever, she thought, I am dead.

Behind her the door opened; Julius's bulky head peered out inquisitively. "Miss Custer? You're soaking wet." His hand touched her arm and drew at her. "You are much too sensitive—too appreciative. It's only our little custom, you know."

Past all resistance, she let him draw her inside; he clucked at her, wiping her dress with his dirty handkerchief. "I'm quite all right, " Helen said.

"Of course you are," Julius rumbled. "But such sensibility! Come, my dear, you must have coffee with Virginia and myself. Quite privately, in Virginia's little sitting room. Just our way, you know, of offering our felicitations to our new colleague—showing our appreciation of your fine spirit."

She went meekly down the hallway; he pushed open a door, and Virginia Hawken's doleful face proffered a smile. She said, "Happy birthday!" She came forward with a cup, and Helen accepted it. "Better now?" Virginia asked. And over Helen's head she exchanged with Julius the worn knowing smile of experience; so this one has hysterics, she was saying, it's better than what most of them have.

"She's quite composed," said Julius. And then he drew from his pocket Ida's penwiper. "You left this at the table, Miss Custer. You know, it is strictly against our rules for pupils to give presents to teachers—I admit I am surprised that it occurred to Ida, and I do hope you haven't encouraged her. But of course you haven't," he said, jovially. "And under the circumstances—"

Helen took the penwiper from his fingers; the shoelace had come untied and the flannel was wrinkled. Automatically she

began to smooth it out and carefully she retied the bow. A birthday present, she thought; the girl had said *I love you, Miss Custer . . . I love you,* Helen thought.

"Ida is a strange child," Julius was saying. "You seem to have brought her out very nicely, I must say."

I love you, Helen thought. And then she lifted her head and said, "Ida has great capacities," and began to drink her bitter coffee while two great tears ran slowly down her cheeks and fell on the penwiper.

SAY IT ANYWAY

By Knute Skinner

In rich anthologies of graves and loves,
the heritage of gold antiquity,
within such catalogs we turn the leaves
where passion's settled into balladry
and sonnets sing the labor and the rest
of heats now cold. So many loved and died
who live this hour accredited in verse,
fed to the scholar's and the schoolgirl's eye.
Time foiled, they had their breath and we their voice.
But here's the comfort for our dated cry
on lips warmed only into present tense:
to say that no one loved as you and I,
who go away with none to meter us.

Three poems

WILLIAM STAFFORD

NO ONE CAN LET GO

To spoil by action is our age's pride:
freedom's the dimension of their wrath,
according to our heroes, but they never
lead us where wheat listens; their coercion
distorts the air we breathe.

No heroes ever found that thinnest line
wise men know. Not the talons, but the wings
and eagle's eyes, unmoving, are our need.
A stepping back occurs beside our path—
freedom is a part of things.

We stand and everything's implied; we know
that people in proximity depend
upon each other. Everyone is dancing
to some music we can't hear. We need
each other, but contend.

No one can let go.

IN THE MUSEUM

Like that, I put the next thing in your hand—
this piece of rock the farthest climbers found,
or this, a broken urn volcano-finished.

Later you'll walk out and say, "Where's home?"
There will be something lacking in each room,
a part you held and casually laid down.

You never can get back, but there'll be other
talismen. You have learned to falter
in this good way: stand still, walk on, remember—

Let one by one things come alive like fish
and swim away into their future waves.

DIVERGENCES

The sleeping of the stars will finally win,
and falling of the snow between,
but there were times—coherence was our home,
whatever came was meant to come,
    and we went forward faithfully.

The way we followed became hard to tell:
faces glimpsed by separate goals,
we turned and climbed apart an immediate rock
and then the next, and then we broke
    the welding of our destiny.

This arm that lifts my hand is not my arm.
At night I walk, leave others, join
by thought again the very path we left
that day we called, "It's for the best,"
    the falling of the snow between.

THE UNDERGROUND

By Frederic Will

Many left who were needed and many
Stayed whom we could not love. The free
Wedding of spirits was declared illegal,
The secrecy of romance was thought to be dull

Obedience, and poetry to rout it entirely.
That's why we went below: thinking that under
Ground we would be freer. Could sunder
Our ways from their ways, and quietly

Celebrate mass, service, or other hope
As we wished it. Our original scope
Was this broad. Meeting each other in the first months,
We were brothers and sisters. No hunter hunts

A cleverer game than we were. Our eyes
Joined us, or a few words spoken in a still
Street. At first we were sharp and wise
Beyond our years. Then we weakened, or, if you will,

Grew. Being asunder had hurt us. Turning
Away, whispering in side streets, earning
Our bread in a foreign land, so to speak,
This had hurt us. The training was good, being meek

Among lions, but being asunder was hard.
One man said: these are my own people
I turn from in the streets. Another: I cannot guard
Each word in a doorway. I must address all

Who will hear me. Many thought in this way.
And began at great risk to say
What they thought. At this point, it is true,
The underground grew weaker. Or perhaps simply grew.

It depends on your stand, of course. Mine
Is that even in a most alarming time
We should speak loudly. But this—it may sound
Odd—I have learned only in the underground.

The lesson of the French crisis

MIREILLE BABAZ and
ALFRED FONTENILLES

More than five months have passed since the momentous events of May, 1958, erupted in France. This may not be the right moment to give a completely objective view of the implications and consequences of these events; yet it might prove interesting for two French teachers who have spent the past summer in the United States to pause and reflect upon the situation of France during this year and to pass on some of their ideas to American readers.

Needless to say, the events of May, 1958, namely the Army's refusal to accept President Pflimlin's investiture, the creation of the Committees of Public Safety in Algeria and Corsica, and finally the appeal to General de Gaulle to become Prime Minister, mark the close of a thirteen-year period of parliamentary bickering and governmental instability. Now we have reached a turning point in our constitutional history. Consequently, it is important to look back upon the determining factors in that crisis, to analyze both the deep-rooted and the immediate causes of the general discontent that led to it, and at the same time to add some reasons for a moderate optimism in the future.

One of the striking characteristics of the crisis seems to be the sense of moderation and compromise displayed by the French at all levels, qualities which we often admire in the American and British political bodies, and which on this particular occasion may have been misinterpreted as inertia. The sense of responsibility of some of our political leaders, of the Trade Unions, and of the French people in general enabled us to negotiate one of the most dangerous turnings in our modern history without any real serious trouble, and to avoid a civil war which would have wrecked the country's unity and international influence.

It would not be fair to make the political system and the successive governments entirely responsible for the ultimate crisis and to stress only their shortcomings without mentioning their

achievements during the last thirteen years: the Franco-German reconciliation, the courageous steps taken towards European unity, the establishment of genuinely fraternal links between France and West and Equatorial Africa, and the progress of the French economy, which now ranks nearer the world's greatest economies than it has at any time during the last fifty years.

Undoubtedly the Fourth Republic stumbled chiefly over colonial policies. Hardly had the long and painful struggle in Indo-China, which impaired our financial resources as well as the morale of our Army, come to an end, than fighting flared up in Algeria. The Algerian problem is certainly the most difficult one our country has ever had to face. As we see it now, the Indo-Chinese situation was relatively simple in comparison with that in Algeria, where more than a million French people have their material as well as their emotional connections.

All French people in Algeria are not wealthy settlers. The majority consists of small farmers, civil servants, teachers, skilled workers, and tradesmen, who all consider Algeria their native country. Whatever solution may be put forward, such as complete integration or federation, it will have to take into account the presence of that large body of French citizens, as well as the difficulties inherent in the coexistence of two separate communities, French and Moslem.

Had our political institutions been more adapted to the growing responsibilities of the modern world, daring and courageous solutions might have been found, even in the face of strong opposition from the Communists on the one hand and from various pressure groups representing powerful interests at home and in North Africa. As it happened, certain defects in our Constitution made impossible any coherent and constructive policy. With such a profoundly divided General Assembly as we had—and which, moreover, in our regime was the fountainhead of authority—any government that attempted to bring out serious measures would fail, as happened too many times.

The realization by the electorate of the impotency of the Executive Power brought about a gradual disaffection towards what many malcontents called the *système*. This cynicism of public opinion, which gave to the *Chansonniers* (those cabaret-singers of satirical songs) a wonderful opportunity to make fun of the

numerous—twenty-four in thirteen years—leaders of our government, also gave rise to a large number of abstentionists, the formation of new extreme parties such as the Poujade movement, composed of small tradesmen set up against the system of taxation, the organizing of the "Jeune Nation" whose avowed purpose was the overthrow of our institutions, and more recently, during the crisis, the flowering of the Committees of Public Safety.

This is why for many French people the critical events of last May were not unexpected. They were rather the climax of a long series of crises and the last step to a renewal of politics which had already been attempted without success. Some political parties, such as the Radicals and the Socialists, had long ago seen the necessity of appealing to the younger people, arousing their interest in public affairs, and thus, rejuvenating the political framework of the nation.

President Mendès-France's ministry, from July, 1954, to February, 1955, will probably stand out as the most serious effort in this direction. The formation of his Cabinet, in which he gave more posts to the young members of the Assembly and to non-political professionals, aroused a great sympathy at all levels and infused new blood into the sedate Radical party. He ended war in Indo-China and launched a number of audacious projects, the most famous both abroad and at home, perhaps, being his crusade against alcoholism. Later he took an active part in the creation of the Radical and Socialist coalition known as the "Front Republicain." Its victory in the general elections of January 2, 1956, brought the Socialist leader Guy Mollet to Premiership. Most of Guy Mollet's efforts were devoted to the pacification of Algeria and the voting of a new series of laws reorganizing the Algerian administration. But inner dissensions in the "Front Republicain," including Mendès-France's withdrawal from the Cabinet, and growing opposition from both the right and left wings, accusing Guy Mollet of being either too progressive or not progressive enough, caused the failure of that second experiment.

After the fall of Guy Mollet's government in the spring of 1957, came a period of transition during which the impotency of the Executive became even more obvious. The stage was set for the third act in which the convergence of more immediate problems was enough to blow the lid off French politics. Every year during

spring and fall certain critical problems occur in the economic life of our country. In the spring, the General Assembly must vote the budget, and this period coincides with a rise in the prices of agricultural products which the government must be careful to check in order to prevent labor demands for higher salaries. In the fall, there is always the same danger with the possibility of a rise in the prices of industrial products.

This spring, the alarming increase in the cost of living jeopardized the already difficult balance of our accounts and fostered the latent feeling of uneasiness of the general public. The bombing of Sakiet in Tunisia and the long negotiations that followed further built up the tension. With the stationing in Algeria of 400,000 soldiers, most of them on prolonged military service, people were all the more impatient to see the problem solved one way or the other. The fall of President Felix Gaillard's government and the long political bargainings leading to President Pflimlin's investiture by the General Assembly at the beginning of May, 1958, stirred great fears among the French population and French Army in Algeria. The French population in Algeria, fearing that President Pflimlin would make excessive concessions to the Nationalist cause, turned to the Army for protection and leadership. Some young and dynamic officers known as "the young Colonels" did their utmost to exploit the situation to their advantage and refused to accept orders from Paris. France was threatened with serious disorders, and this open split of opinions and interests between France and Algeria might easily, at any moment, have degenerated into civil war.

The appeal to General de Gaulle, in spite of the fact that it came from the worst opponents to the system, the Army and the Extreme Right, seemed then indispensable, even to many who felt reluctant about his return to power. The mass demonstrations that took place in those days, mostly in Paris, were not directed against General de Gaulle himself but expressed the determination of the French people to refuse any form of dictatorial authority. The ultimate rallying of most political parties, some of them acting reluctantly, others being strengthened by popular support, proved that the nation, having realized the emergency and the acuteness of the crisis, preferred a reasonable although compromising issue to the horrors of civil war.

It is yet too early to pass complete and unbiased judgement on the de Gaulle experiment and to make a detailed forecast of the positions he will take on major issues. He is faced with difficult situations at home and abroad, such as the future relations between France and her former territories and protectorates in Africa, the problem of European unity, the great administrative reforms required by the transformation of France into a modern industrial nation, the modernization of our educational system, and the establishment of a new system of taxation better adapted to our present development. In the first three months of his administration, General de Gaulle, before considering the abovementioned problems, has set himself to complete and consolidate his government, to establish friendly contacts with foreign nations, to pacify the French citizens of Algeria, to secure better control of the military machine, and, generally speaking, to lay the foundation for future French leadership in European affairs. However, in his eyes, the answer to these questions is subordinate to the one important and urgent reform, namely the reform of the constitution.

At the end of July, a first constitutional draft was presented to a Consultative Commission of thirty-nine members. This draft is by no means to be considered final and is apt to undergo several revisions before being submitted for popular approval at the referendum this fall. But the general outlines of the Constitution-to-be are easily distinguishable and our purpose here is to focus our discussion on them.

The stumbling block of the Fourth Republic was the place and role of the Executive. There had been a failure to realize that a modern democracy implies a strong and stable executive power. To be strong, it must be backed by popular suffrage, and to be stable, it must disentangle itself from petty parliamentary skirmishes. To fulfill these conditions, the proposed Constitution gives a key position to the President of the Republic, who will be elected by a broadened electoral college. During the Fourth Republic, the President was chosen by the members of the two Assemblies gathered in Versailles. In the new Constitution, the Presidential College would also have county and town representatives. This solution seems to be a compromise between the plebiscite type of election, held in great distrust in France since Louis-Napoleon

Bonaparte, who used the Presidency as a stepping stone to personal power in 1851, and the former system which made the Legislative Assemblies the sole depositaries of the public will. The technical details of this election, particularly as concerns the respective percentages of urban and rural representations, have not yet been settled, but the important point remains—the general desire for strengthening the authority of the President by widening his electoral basis.

So far, what the Presidential prerogatives will be under this new Constitution is not very clearly known. It would have been simpler to grant him the same powers as those of the American President, who governs with the collaboration of the members of his Cabinet, who are solely responsible to him but who are dependent upon and controlled by Congress. A more or less explicit desire for constitutional continuity and a wish not to hurt the Parliament's feelings to too great an extent prevented the adoption of such a solution. Therefore a Prime Minister and Cabinet responsible to the Assembly or Assemblies will have to be the necessary instrument of Presidential action.

In the 1958 draft, the President of the Republic is not so much the Chief Executive as a kind of arbiter (the word " arbitration" actually appears in the text) between the Executive and the Legislative powers, and the term is to be understood with its judicial implications; he is the man who, after hearing the case for each side, makes the final decision. In the event of a conflict which cannot be resolved between the Assemblies and the Government, he may resort either to the dissolution of the Assemblies followed by new elections or to a direct appeal to public opinion through a referendum. This solution, which for the time being seems to have the favor of the general public, is regarded with suspicion by Parliament members, who resent that permanent threat to their political mandates. Nevertheless, in order to make popular arbitration valid, there should be equal risks involved for those having recourse to it. By using the dissolution or the referendum, the President must commit himself personally in the debate, and, consequently, if he is defeated, he must be ready to abandon his office, as there can be no real authority without responsibility. This may lead to paradoxical situations in which we have the arbiter being a party to a conflict and having, on principle, to sub-

mit himself to the super-arbitration of the people. Yet so far there is no clause in the Constitution providing that he must do so.

There is another prerogative of the President, more important still, which provokes much discussion and concern. Whenever the integrity or independence of the nation are endangered—the vagueness of these two words is a danger in itself—the Constitution grants him the right to assume exceptional powers without any parliamentary or popular control. In that event, by a purely unilateral decision, he assumes, so to speak, dictatorial functions as long as he deems necessary. Whatever frightening prospects this provision may open, it must be understood that it corresponds to a profound desire to have the highest authority in the state remain "apolitical," out of and above the political parties, and this justifies, in many people's eyes, the exceptional powers vested in the President in times of national emergency.

From the desire for a clear-cut separation between the Executive and the Legislative proceeds the incompatibility of parliamentary and ministerial functions. The members of the Cabinet chosen by the Prime Minister and approved by the Assembly will either be selected from higher civil servants and professionals or from members of Parliament, who will have to resign their mandates for the duration of the legislature. This is a very important point, perhaps the most important of all. The Prime Minister will have more freedom to choose his collaborators, and it might put an end to or at least curtail the usual bargainings that have gone along with the distribution of ministerial offices.

On the other hand, the mechanism of governmental responsibility has been reinforced and simplified. The Constitution of the Fourth Republic allowed the General Assembly to reject a law by a simple majority without overthrowing the government, unless the government had asked for a vote of confidence on that particular law. The new Constitution provides that the mere rejection of a law will be the equivalent of a refusal of confidence.

There is nothing new in the organization of the Legislative power. The two Assemblies will be elected along much the same lines as before. The most notable changes lie in the shortening of the sessions to six months, and in the reduction of the influence of the Assemblies over the Executive, particularly during their long periods of recess.

It would be preposterous to predict how the new Constitution will work, since it may yet be amended or may even be rejected by the French people. If it is accepted, as we think it will be, its success will depend in large part upon the personality of the new President and upon the readiness of Parliament to accept its new position in the Constitution.

AFTER A TRIP TO THE ART MUSEUM

By Paul Petrie

Renoir or Cezanne; it came to that.
But slumped across the tragic wicker chair
that gnawed her trousseau slip; and, thunder-backed,
hanging ties like martyrs on the wall;
they could not even find their quarrel out,
let alone be plausible in tears.
They might have dodged by several ready feints;
but still themselves, and young, and close to fact,
they could not come too close to what they felt,
or hide it in a name it wasn't called.
And so they ached, till she gave up her pride
in naming things, and wept their difference whole.

They learned as much as lovers ever learn
this side of love; but still the central flaw
of space was touched.
Those Frenchmen and their fruit!
Why will they put their worlds in separate bowls,
where the young can pick the apples up and bite.

Windows to the sky

PHILIP MORRISON

When an infant is brought out into the moonlit evening, it may reach its hands toward the moon. That bright light affecting the eye of the child is a symbol, I think, for man's ancient regard for the heavens, for what goes on outside the earth, in places where until recently he has not had the chance to set his foot. It is the eye which has in the first instance made this possible. They say that, if you examine the structure of the brain of those clever hunting animals, the dogs, you will see that the largest fraction of the surface given over to the receiving areas of the senses is that devoted to the service of the nose, that wonderful instrument which can as we know follow mere empty footprints of the missing heroine into the woods. But for man, the visual cortex occupies ten times as much space as does the region in which is displayed the grasp of any of the other senses. Men, and probably all related tree climbers, from whom we have long ago descended, see and receive their knowledge of the world very much through the eye; the eye has been the channel from which the ideas of the earth nearby and, marvelously enough, the world very far away have been formed. The eye, if you like, is shaped by the sun itself, for it is the particular colors of the light of the sun that the eye sees. It sees because there is light to see; otherwise the eye could have had no function. It could not have come into being in the remarkably adopted form in which we now find it. So we cannot say it is mysterious, but rather, it is an inner consequence of the very nature of men that they must be interested in, and be able to study with the eye, the objects of the heavens: in the first instance, the dazzling sun from which all life wakens. In some ways it is the most urgent of all objects of astronomy, but I will not give the sun the role which it ought to have, as our star, the star around which we live.

The Egyptian priests, four or five thousand years ago, learned

to predict the time when the Nile would bring in its flood, new life to the dry lands of North Egypt, from the rising of Sirius at dawn. And certainly long before that, men watched the sky and found that order from which they have constructed the rest of science. Natural law in its crudest form was an idea gained from studying astronomy, visual astronomy without aid of telescope, without aid of any instrument except the remarkable inborn instrument, the eye, which guaranteed the very survival of man as a living being, an animal. To find order even in the apparently irregular, superficial wanderings of a planet was the triumph of the visual, naked-eye method of astronomy; and from the oldest Mesopotamian tablet to the glorious discoveries of Copernicus and Kepler, upon which the modern sciences stemming from the Renaissance were certainly built, we could not possibly overestimate the brilliance with which this sensory means was put to use in so construing the world. Now, of couse, this is not enough, as we have learned. It is the pride and the burden of science today that we have come to study the world not alone through the channels which are built into us, but through a variety of subtle sense-instruments, which belong to the man who uses them as surely as do his eyes or his fingertips or the membranes of his ears. And in the America of the fifties when more people see daily cathode-ray screens in the television tube than, I think, in the whole history of the electron before 1946, it would be absurd to have to point out how complex and remarkable, and yet how easily used, can be the instruments of science.

What I want to describe under my slightly enigmatic title is the way we are today replacing the eye by the camera. This is, of course, a commonplace of our magazines but a beautiful one. I shall show, too, some pictures produced by the present-day optical astronomy, to comment upon the subtleties which this instrument now brings us. But I want to go much beyond that. I want to speak not only about the astronomy of the eye, but about other astronomies. Some of these you know; they are well developed, like the astronomy of radio. Then I shall describe a whole set of astronomies which, in my opinion, will one day bring us as much novelty about the worlds outside our earth as we now see, but through channels and by instrumental means, by new senses if you like, which were not given to us or to any other living crea-

tures, senses which we are only beginning in the most hesitant and halting way to exploit. So what I have to say is in the nature both of commemoration and of forecast, and I hope in that spirit it will be received.

Of course, the eye has long been replaced, or all but replaced for the astronomers' investigations, by the camera. There is the great telescope, as we call it; it is really a camera, a camera of special optical design. And in the use of the camera we find most remarkable phenomena which would have remained unknown and lost had we not had these powerful methods at hand. These methods grow in the interplay of means and problem which has been characteristic of this as of most fields of science.

Figure 1, which is the first of four different views of the Crab Nebula, is a rather unprepossessing photograph, taken through a great telescope, which deliberately underplays the shot, showing the Nebula as it might look through an amateur's three-or-four-inch telescope on a good day. It is an object found in the fall and winter sky, impossible to see with the eye alone but quite visible as a light patch of this shape in a small telescope. This Crab Nebula was discovered, written down for science, in the last half of the eighteenth century. It has been an object of interest and study ever since that time, acquiring since 1940 or so an illustrious position in the history of optical astronomy, the astronomy of ordinary light, the astronomy of the eye.

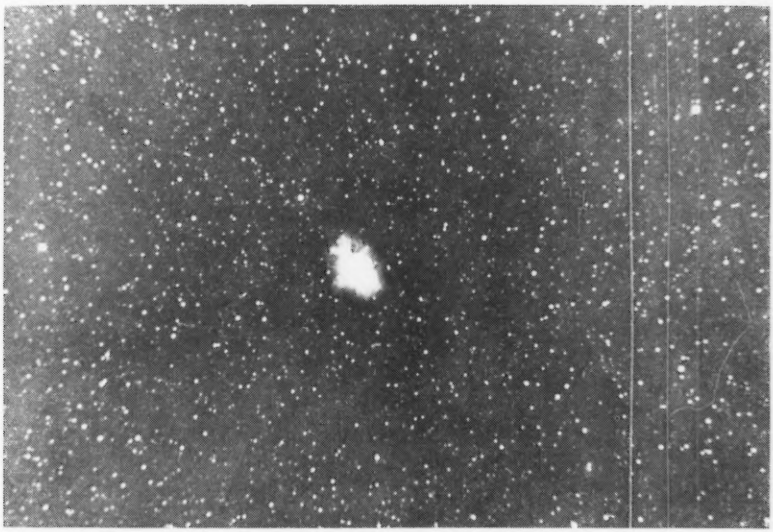
Optical astronomy has made one of its most spectacular achievements in the study of this object. Figure 2 shows the same object on a much larger scale. Notice the network of filaments. These filaments are known to move. They were watched over a period of twenty years by the patient astronomers, and their positions were plotted. They were found to be moving; little features could be recognized. Once you knew how far they had moved in twenty years, you could say roughly how far they would move in forty years, and you could not only know the motion forward in time but backward in time. While the motions show an expanding cloud at the moment, it is possible to shift the cloud backwards in time. As you go back nine hundred years, this moving, expanding cloud projects back down almost to a point. Not quite

one point, because there are, of course, all sorts of irregularities and difficulties in measurement—but almost to a point, convincing us that the cloud we now see is the moving remnant of a terrific stellar explosion around the year 1100.

Investigation of astronomical records in the Far East revealed that indeed a star in precisely this position had suddenly appeared in the sky, in late June of 1054 A.D., and was duly recorded by the Chinese, the Japanese, and the Korean astronomers of that time—men who had, of course, only the eye to go by, but who were scrupulous observers. They gave us not only the position, but they gave us the light curve: how bright the "guest star" was month by month until it faded away. It was so bright it could be seen by day. It was brighter than anything else in the heavens except sun and moon. Finally, it faded in a year or two, so that it could not be seen any longer by the astronomers without telescopes, to whom we owe these early data. So this Crab Nebula is in fact a giant explosion. I would like to be able to give a fuller account of how we can analyze this explosion, but it is not necessary. Here I am not trying to describe all the fruits of optical astronomy, but only to show the kinds of things which one may learn.

It is known now that the Crab was a gigantic thermo-nuclear explosion, far greater than anything men can make, an explosion precisely similar to one which must have gone on five or eight billions of years ago to bequeath to the earth the legacy of all the heavy elements upon which so much of our technology is built. Without this legacy of explosion we would have little or no gold, or lead, or uranium; it may be thought of as a kind of moral question, if you will enter into that conceit with me, because certainly in the history of man, lead, which makes type and gunpowder and bullets; gold, which we have good evidence to consider as "the root of all evil"; and uranium, which is perhaps a newer version of the same urge, play a special role in human history.

It is quite curious to realize that there is no biological need for any of these heavy elements. One can imagine that somewhere there is a happy planet, still in the stage of the Garden of Eden, which never received legacy of the explosion of a super-nova. Perhaps that violent burst is the original sin for which we still do penance. There is one real sense in which this can be shown to be



Figures 1 through 4—Four different views of the Crab Nebula. Figure 1, the small one, is from the Yerkes Observatory.

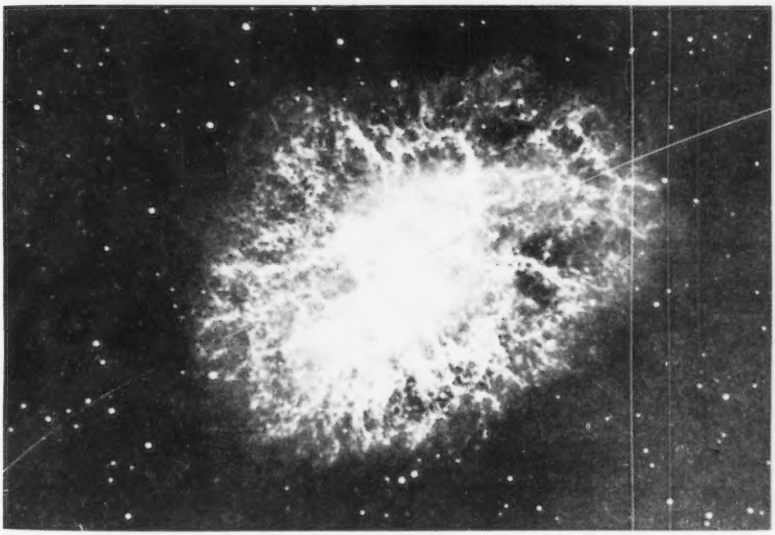


Figure 2 showing the filamentary structure, is taken in the color corresponding to a strong emission from hydrogen atoms.

Figure 3 is taken in the near infra-red and discloses the smooth amorphous cloud central to the object.

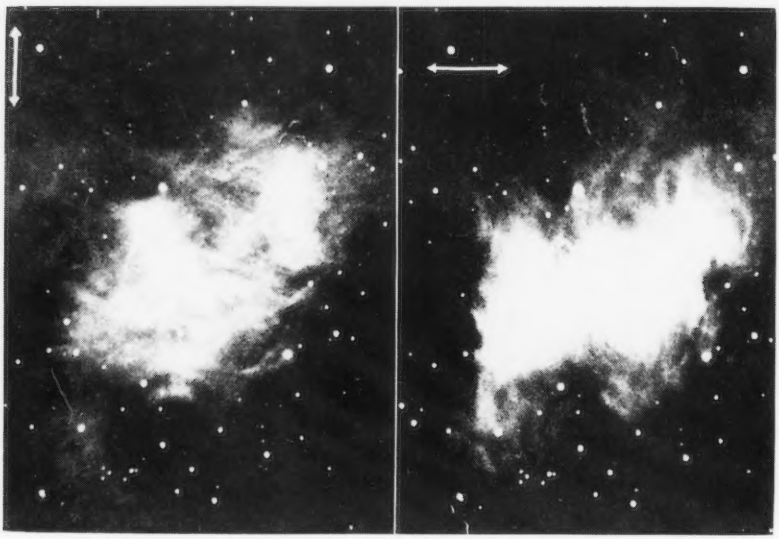


Figure 4 shows the amorphous cloud seen in one direction of polarization of the light. The latter photographs are all due to Professor W. Baade at Palomar.

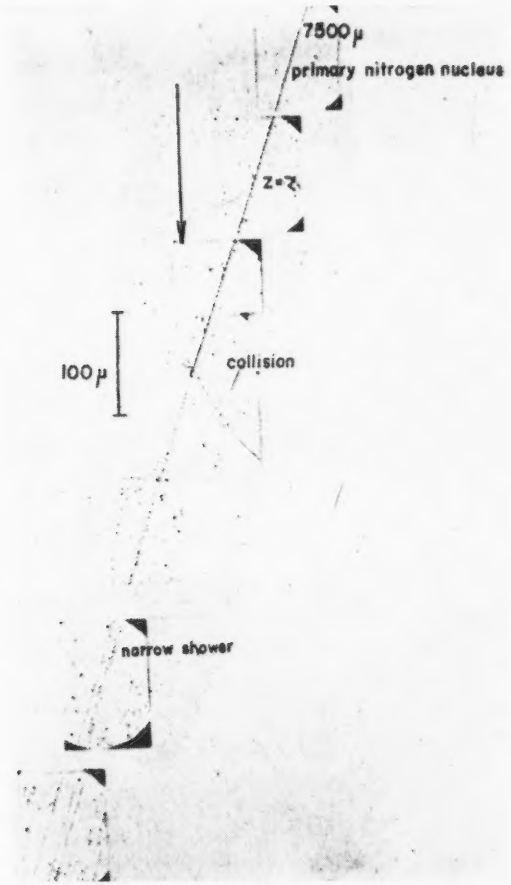


Figure 8—A track of a nitrogen nucleus in photographic emulsion flown at high balloon altitudes by Bradt and Peters of Rochester.

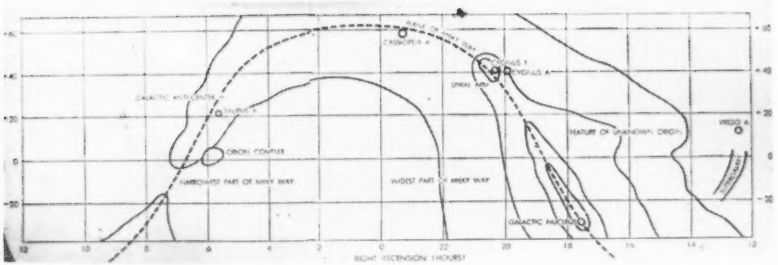


Figure 6—A radio map of the Milky Way made by Professor J. Kraus of Ohio State University.

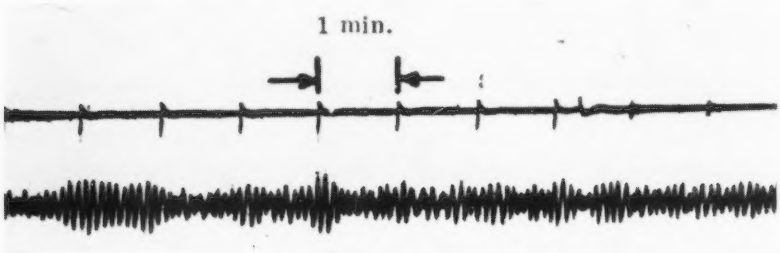


Figure 12—Magnetic record showing the periodic disturbances which might be ascribed to "magnetic sound".

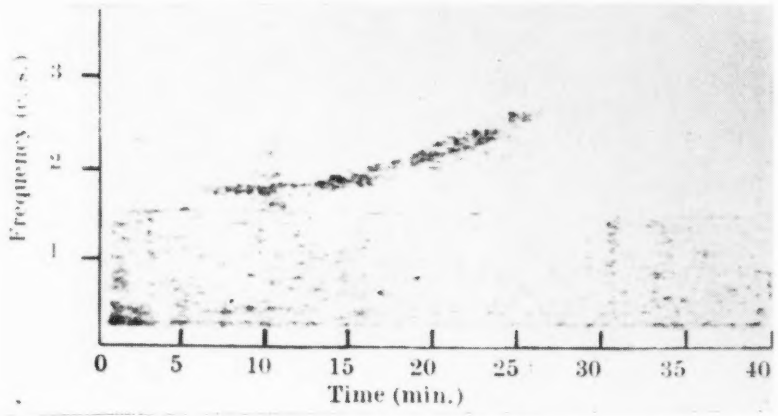


Figure 13—The frequency of such a disturbance as that of Figure 11 shown rising steadily with time. The last two figures were made by a group at the Pacific Naval Research Laboratory of the Royal Canadian Navy.

true. The energy of this explosion was not all released; some of it remained stored in those heavy unstable elements which we make use of today, so far mainly to our sorrow.

Figure 3 is the Crab again, and I use this picture to make clear how artful are the ways af the telescopic camera. The difference between the last picture, with its crablike filamentary structure, and this picture is a difference of color. This picture is taken in a very deep red, almost beyond the grasp of the eye. The other picture was taken in clear red. This difference in color is enough to disclose, underlying the filamentary web, an amorphous smooth cloud, which sends out light through all the range of colors, one of the most remarkable features of all optical astronomy. How remarkable it is can be judged by the next picture (Figure 4), which shows that same object, taken in the same color, but under two different circumstances.

If you pick out any two corresponding bright wisps, you find that their shapes are quite different in the two views. These don't look like the same objects at all. What makes the two views different? The two are taken through polaroid; the orientation of the polaroid material is different in the two pictures. Some parts of this cloud give off light which is polarized in one direction; some parts, a light which is polarized in another direction. This was the first demonstration in all the heavens of a source of light which is very much polarized. We have only one interpretation of this, which is that this polarization reveals a kind of directed motion of the particles that give out the light. The directionality can be imposed only by the presence of magnetic fields. The mind, of course, can imagine some gigantic magnets. On this ground we are prepared to say that this cloud is filled with a vast pool of relatively rapidly-moving particles, electrons and protons, the particles being called cosmic rays, but a million times more intense than the cosmic rays received here on earth.

To try to dismiss optical astronomy in a paragraph or two, even by showing its most spectacular accomplishment, does not do it justice. I cannot do it justice here; rather, I am trying to show one way by which we have learned something, indeed most of what we know about the world outside earth. But it is not the only way. You all know that, in the last decade or two, more or less during the rapid growth since the close of World War II, we

have built a new astronomy, closely related to the old astronomy, yet distinctly different from it. For the new astronomy we look at the sky not in light but in radio waves. Now, radio waves are imperceptible by any of the biological senses. (This is even fortunate perhaps; we need to turn on a switch to sense any of the programs that are going through us at the present time.) Nevertheless, it is as real a fact of experience as you can imagine, in our day and age. The air—or the vacuum—is filled with an innumerable collection of varying fields which we call radio. It is enough to remind you in a word that light is but the radio of the atom. For light the transmitter is atomic. If the receiver is also atomic, like the chemical substances in the retina or the photographic plate, or the electrons in the photocell, the waves transmitted from one to the other we call light. But if the transmitter instead is a wire a few feet long and if the receiver is the same sort of thing, then the wave transmitted is not of atomic dimensions, but

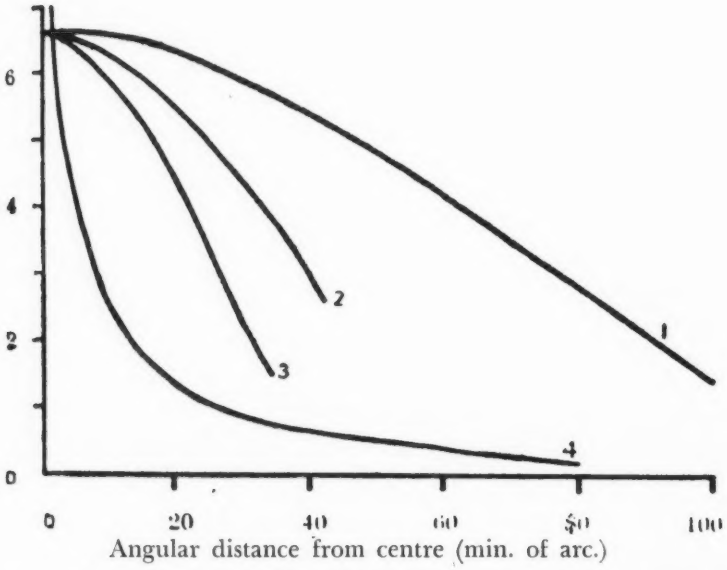


Figure 5—Graph of the apparent intensity seen in the Andromeda Nebula as a function of the distance of its center. Curve 4 shows the appearance in optical light. Curve 1 is the radio result obtained by J. Baldwin of Cambridge University.

has a wave length measured in yards. We call this radio (or UHF, anyway). This is our TV or FM. In this region of "color," too, a kind of astronomy has been found and exploited very ingeniously in the last ten years. It can be said to have made a great success.

By the radio waves, we "see" a variety of objects, but we have a quite different way of looking. We have means to observe which are relatively primitive, but which do give us some detail in this quite new kind of light, distinctly different from the light perceptible to the eye. We see new stars, some of amazing brilliance, even though they are very remote. You see in Figure 5 a curve, which is not very picturesque. (It is a characteristic of radio astronomy that its results are still graphical, not images in which everything is depicted at once.) This is a cross section through the famous Andromeda Nebula, which appears as a tilted disc in the photograph. Fix your attention on the outermost curve marked 1, and on the innermost curve marked 4. The innermost gives the visible brightness for various distances from the center of the image. By radio we see the outer curve, a very convex curve, which demonstrates that, though we look quite far from the center, the radio brightness has hardly diminished at all. To the radio telescope the Andromeda Nebula is not a flat disc but a great ball, nearly uniformly bright throughout. Something around the Andromeda can send out radio waves, though it cannot send out light. This demonstrates directly how we see the world in a new way whenever we open a new sensory channel.

We see in Figure 6 a more familiar kind of image—a map. The map is to summarize the results of radio observation of the sky. You see a map which bears a strong general resemblance to photographs of the Milky Way, except that there are no dark patches obscuring the light. There is a bright central region which fades off more or less in both directions along the band. No dust is able to obscure our radio view; we see a new collection of stars (we may call them stars) which bear very little similarity to a map of the brightest stars seen in the optical telescope. The constellations look completely different. A few exceptional objects, like the Crab, which we can see in an optical telescope reasonably well, would be brilliant radio sources. Most of the radio sources would be so faint optically that we could not see them at all with any but the most powerful optical telescopes. We can barely see that

which is the strongest of radio sources, next to the sun. The sun itself is very strange: by radio vision variable, uncertain, erratic, ranging in intensity by factors of a thousand or a million in a few hours at various times during the solar cycle. Were visible light as variable as radio, life as we know it surely could not exist. Radio waves are not important parts of our sun's output, yet the sun is a powerful source of such waves.

All this suggests, there are many colors—or wave lengths—of light. We know of the ultraviolet and infrared; we know of radio, we know of x-rays; we know of a whole gamut of light, the spectrum. I have calculated—and one can calculate this pretty well—what we may call the available windows for electro-magnetic radiation which are open to us. In the top curve of Figure 7, you see the following facts represented: If the curve is on the bottom line, the atmosphere is quite opaque. If the curve shoots to the top, the atmosphere is quite transparent. Anything in between, of course, means that the atmosphere gets more or less of that kind of light. Now the kinds of light are represented by their frequencies (along a logarithmic scale, for those who are familiar with this sort of representation). Each octave has the same length; across the bottom it is marked DC, AC (the 60 cycles we are familiar with), radio, microwave, infrared, ultraviolet, x-rays, gamma rays. The whole spectrum is there displayed. Now, where are the windows through which we can look to see what is coming to the earth? Notice that there is one hundred percent transmission in a little "window" that stands out. That is the window of visual astronomy. Optical astronomy is possible because the air transmits light. Because the air transmits it, our eyes can see it. This property is related closely to the chemical nature of the atmosphere and of the elements which make up living matter. We notice at either side of that window a little structure going out to the infrared, through which clever people may peer once in a while. It is not a very wide opening. To the left we see a few black spikes, a complicated structure depending on the ephemeral presence of CO_2 and water vapor, special components in the air, which simply pass those particular "colors" in infrared. But a little bit to the left, or a little to the right, you come to a dead, opaque blanket. The amosphere is a heavy black velvet curtain in those frequencies; that blackness continues, going to the left,

until you enter the very short, microwave region, where the waves would be no more than a millimeter or two in length, super-radar wave lengths, where a few spikes appear. Finally a long, clear region arrives, which is the window taken advantage of by the radio astronomer whenever his great parabolic dishes stare at the sky.

You see then that we have, within the atmosphere, only two big windows, with a few minor slits or portholes; that exhausts what we can hope to see by standing on the surface of the earth looking out, as long as we confine ourselves to the analogs of light. This really spans the possible electromagnetic astronomies. One of them is beautifully exploited, the astronomy of the eye; and the astronomy of the radio antenna is very well exploited—though it has perhaps passed its infancy, it is still in a vigorous early adulthood.

Now you may say, all this is old hat. Of course, it is in a way, because we know these days we are not limited to the surface of the earth. We all look forward eagerly to astronomical results from beyond the earth's atmosphere, not only those few satellite results, but other fascinating ones which can be obtained from high balloon flights lasting a few hours, not quite at the top of the

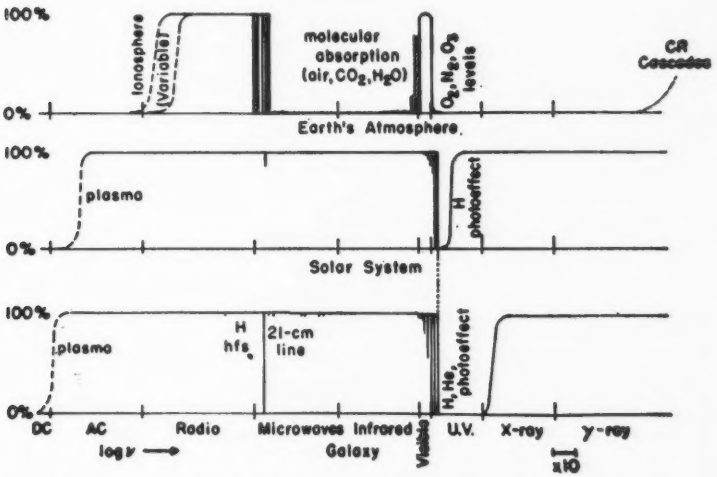


Figure 7—Three graphical descriptions of the windows for entry of radiation into the three labelled regions.

atmosphere. And rocket flights, lasting a few minutes but well out of the atmosphere, are familiar. But we look forward to flights which may orbit for months or years far out of the atmosphere; and someday to stations which can take a solid position on the moon from which we can study for a long while.

Such stations beyond the atmosphere do not, however, find themselves completely free from obstruction. There is still the solar system to peer through, and it is filled with a tenuous gas. Out there they have a wonderful window; there is, you see (Figure 7, the middle curve), only one region which is obscured to them; but that remains quite dark, one cannot see in that region. That is the region of what we call soft x-rays. And it is made dark by the characteristic absorption of the simplest, most prevalent element: atomic hydrogen. We cannot penetrate the fog of the hydrogen without leaving the solar system. Almost everywhere else it is perfectly clear. Down at the very low frequencies, note the dotted line at the lefthand edge of the graph. The low-frequency limit is set by the ionosphere of the earth's atmosphere, or by similar phenomena in the ionized gas of space. These may vary with local conditions; we have to draw the limit in a somewhat tentative way. Perhaps windows would open up one year which would be closed another year, in this variable region of low-frequency studies, still very far from complete.

Finally, I drew the window in the lowest curve as seen by an observer who managed to get his station out of the earth's atmosphere, even out of the solar system itself, into the depths of interstellar space. Out there he sees, unfortunately, a black barrier to transmission, again arising from hydrogen. It is curious that, while everything else is open to us, for all we know the space beyond the galaxies could be blazing bright in this particular part of the spectrum, and we have no direct means of finding it. It may be one of the more important questions to ask how hot is that extraordinary empty space between the galactic islands which we occupy. This example is only to show that the nature of channels through which our knowledge appears, the nature of the windows, is one of the most important conditions on the formation of the grand concepts which we try to form about the world of the very large.

There is a kind of halfway house which I would like to talk

about because I myself began to work on it recently. And that is the use of the gamma ray. Gamma rays will not penetrate the earth's atmosphere. The earth's atmosphere is thick for them; but the gamma rays, which are super x-rays, will penetrate a foot of water. A foot of water is equivalent to a good many kilometers of tenuous air. These gamma rays will come, not down to the surface of the earth, but to easy balloon altitudes. They die away a little, but much is left by the time they reach seventy-five or eighty thousand feet up, where cheap balloon flights can reach. Gamma-ray astronomy, still an unexploited branch of the science, may tell us a great deal because it opens a window much more directly connected to nuclear processes of stars than light can be. Gamma rays are emitted in every such nuclear reaction as the reactions that occur on stellar surfaces. So far we study nuclear reactions in stars by indirect inferences about what kind of light must eventually be produced when the nuclear energy is degraded into commonplace heat and light. It will be very agreeable to have more direct evidence from the characteristic gamma rays directly emitted, and I hope that this will soon be on hand.

The *New York Times,* a very important source of scientific information these days, tells us that in Sputnik III there is a gamma ray counter of some sort. One is anxious to hear what was learned, but we'll have to wait for even more sober publications before we know what the facts are.

All that I have said is really rather straight-forward. It would pose an interesting problem to a graduate student to work out. Indeed Figure 7 was computed for me by just such a graduate student, as part of his recent examination.

But now we come to points which are a little bit less familiar. I have tried to lead you from the living eye and the familiar radio on to the still somewhat vague, but yet understandable, notion that there is light of many kinds, of all wave lengths and frequencies, through radio, through the visible, into gamma rays. These all are the analogs to light. One property they share which is most characteristic: they come in rays. They travel through nearly empty space in straight lines, as they do in any homogeneous region. This means, of course, that the message that they bring us, the information that flows to earth, is marked inextricably, and very valuably, for us, marked with the direction of its origin.

When we see the light we know where the lamp lies; that's the key to the messages of light. Certainly that is the most directly interpretable kind of astronomy. But it is not the only kind of astronomy.

There is another fine old kind of astronomy: astronomy in which the message is brought in as a meteor. One may recall for example a particularly fine object, a meteorite such as students do not see every day, quite fortunately—a twenty ton piece of iron alloy, which was brought down from where Peary found it in Greenland thirty or forty years ago and now sits in display in the museum in New York City. The meteor is a chunk of matter which comes from outside the earth. As such, it is the only sample at the moment of material from outside, and this is extraordinarily important. It will perhaps be less important as time goes on. It has done something for us that no light can do; it has provided direct samples of material. What it does not do—which light can do, of course—is bring us the clear mark of where it comes from, because it does not come to us in a straight line; it comes to us, having been stored in a complexly gyrating orbit, maybe for hundreds of millions of trips around the sun. At the instant of collision with earth, we know where it was going, but that's all. It has never travelled in a straight line. We are all but certain that every meteor we have ever found—from the biggest ones which, I think, have been big enough to carve out half of Hudson Bay, down to the dustlike grains which flash up to the eye and to the radarscope every minute and every hour of the year—comes in an orbit by gravity and has moved very far. They probably dwell within our solar system, and they tell us about that system. This is a kind of astronomy in which studying matter, which is an extremely rich and interesting "channel," is quite as important to us as light. We know that between matter and light we include most of what we sense in our everyday experiences.

Another form of matter comes in to earth. Again we detect a sample of matter from outside space. Again we see something that has not moved in a straight line; but its magnitude is so different from the magnitude of a great meteor that it seems wholly different. It is a cosmic-ray particle. In Figure 8 we see a cosmic-ray track made in a photographic emulsion, flown in a balloon high in the atmosphere. Here it is very much magnified. The scale

mark on the cut is a four-hundredth of an inch, a tenth of a millimeter. Therefore, this whole track is only a little scratch about a quarter of an inch long, a little gray scratch in the photographic emulsion—not very spectacular. Simply looking at it in the microscope reveals its structure; thus we can well analyze what happens to these little meteorites.

In the first place, it was not ten tons of matter, nor was it even a dust grain. It was one single atom, in this case an atom of nitrogen. Here the physicist can chemically analyze a single atom by the kind of tracks it makes. This is nitrogen and nothing else. It is nitrogen from outside space. It is going fast, unlike a meteorite, which moves only at Sputnik-like velocity. This atom is moving at the velocity of light, or rather very close to that velocity (about a half of one percent more slowly). Its weight is much greater than its ordinary weight; its near-limiting velocity is expressed by increasing the mass of the particle. The atom is also terribly energetic as it goes through the photographic plate and leaves an ionized track; it can make nuclear collisions and at the end proliferate into a vast variety of tracks. A rain of such particles on the upper atmosphere is the cosmic radiation, spread throughout the whole of the earth's surface, every now and again going down through the building and striking you individually —one or two per second per person, is about what one can count on. These down here are not the original rays. What we can measure with the Geiger counter, for example, coming to us here, is the great-great-great-grandchild of the incoming cosmic ray—the result of many intermediate collisions with the resting nuclei of the air, collisions which chip the nuclei and fragment the result. So much energy is available that the ray cannot stop. It goes down, down, and its products are not all lost even a thousand feet underground, where there is still cosmic radiation perfectly detectable.

These rays are very wonderful. They are matter, but they are matter going so fast that they might come in a straight line. For what could possibly bend their paths when they can go right down through all the layers of air into the bowels of the earth in a straight line? That is not quite true. They are bent in a subtle way, not by gravity and not by matter, but by magnetic fields. They bend in the earth's magnetic field. They bend in the fields

that can be made in the laboratory; and they are surely, as we now know, bent and stirred into a tortuous path by the complex magnetic fields that exist in outer space. It is, in fact, the analysis of these particles which is one of our strongest pieces of evidence that space is not empty, but contains magnetization borne by very dilute material. This magnetization conceals from us the direction from which these cosmic-ray meteorites come, just as the gravitation of the sun conceals the direction from which the chunks of meteor come. The meteors are going so much more slowly and have relatively so little electric charge that they cannot feel the magnetic fields; but they do respond, as they must, to the gravity which rules the planets.

Cosmic rays can be found deep in mines or high in balloons. A cosmic-ray observatory may be set in a salt mine or on the top of a mountain. In either case, you may learn some features of

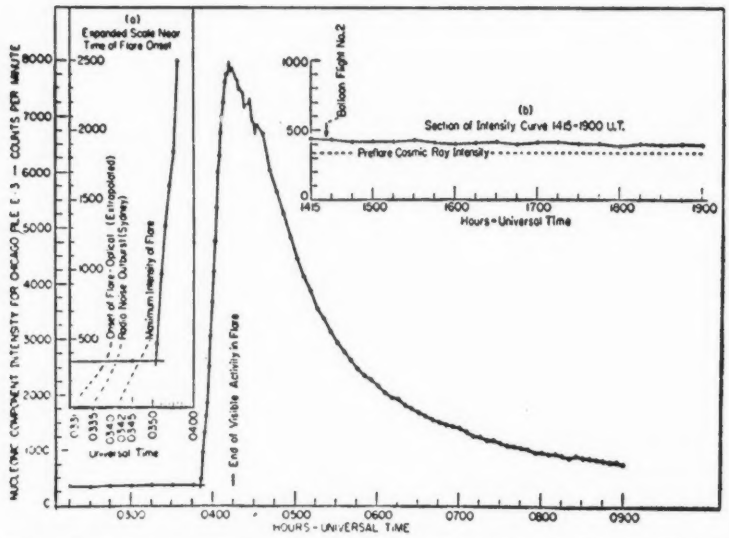

(a)
Expanded Scale Near Time of Flare Onset
(b)
Balloon Flight No. 2
Section of Intensity Curve 1415-1900 U.T.
Preflare Cosmic Ray Intensity
Hours - Universal Time
Onset of Flare Optical (Extrapolated)
Radio Noise Outburst (Sydney)
Maximum Intensity of Flare
End of Visible Activity in Flare
Universal Time
HOURS - UNIVERSAL TIME

Figure 9—Cosmic ray intensity measured at Chicago by J. Simpson during the great solar outburst of 1956.

these rays. They are astronomical in nature, their study another variety of astronomy.

Figure 9 is a graph of cosmic-ray intensity on a famous day,

February 22, 1956, when to celebrate Washington's birthday a great solar flare, in many ways the greatest known, burst out. It was not visible in the High Altitude Observatory of the University of Colorado, because it appeared near midnight, a time when it is not very easy to see the sun, even in clear Colorado. But the cosmic rays didn't mind that; they came here from the sun, even at midnight. A burst of cosmic rays came in, fifty times as many as normally came into the station at Chicago. At the same time accurately to a few minutes, observers in Japan could see on the surface of the morning sun the phenomena of the special solar eruption. This time coincidence is so strong that we cannot doubt this is what happened. That the cosmic rays come from the sun at a time when no sun is visible, is a demonstration that cosmic rays bend in the earth's field and can go right around to strike the dark side of earth, whereas light rays travel in straight lines. The event lasted for many hours. There is no space to describe it fully, but it exemplified what I mean by cosmic-ray astronomy: particle astronomy, not radiation astronomy of any kind. It is meteor astronomy on a very small scale.

The problems of unraveling it all are taxing and fascinating. They have very much to do with the nature of magnetism and, curiously enough, with the way particles can be speeded up by magnetic fields. Such processes are of burning interest to those of us who want to see the manmade, controlled, useful release of thermo-nuclear power; that release is almost surely to be made by manipulating such magnetic fields. The rays are real samples of remote matter; they come from all over our galaxy. They come, as we must believe, from explosions like the Crab outburst. Recall that they cannot come in a straight line. If your counters look toward the Crab, they see no more cosmic rays than elsewhere. We believe they come out of the Crab in plenty (the Crab is an expanding magnetized nebula), but by the time they get to us, they have forgotten where their home was. Neutrons and electrons can likewise be seen. Back at Cornell my colleagues are looking for neutrons from the sun—which can come in straight lines —by using great counters like no telescope you ever saw, but rather like a cartwheel made of lucite at which the photocells stare to notice the slight flash as the rays hit, much as the luminous

watch dial flashes when the alpha-particle of the radium-painted dial releases its energy within the fluorescent material.

I go to another kind of particle, one permitting a kind of particle astronomy, and not light astronomy, but altogether singular. This is the little particle called the neutrino. We know today that the sun is a great nuclear engine, and that the center of the sun is where its main fires are kindled. The outside of the sun glows because the light and heat from deep within have reached the outside by a slow process of conduction. We may compute that it takes light about ten thousand to a hundred thousand years to travel from the center of the sun to the surface, where first it can escape to reach us. During this time it changes in many steps from a gamma ray to an x-ray down to a visible range. But the neutrino is an invariable product of the same nuclear reactions that make the sun shine, and amounts in total energy to about one part in ten or twenty of the solar output. That is quite an appreciable fraction. It comes out in each nuclear reaction in the depths of the sun, moves in a straight line right through the body of the sun without being deflected or deviated in the least by the intervening matter, and passes out into space. Indeed, there is a stream of neutrinos going through you as you read, many times more abundant than cosmic rays, of the order of a million every second. This is just as true when the sun is overhead, as when we are at midnight and the sun is underfoot, because neutrinos capable of directly penetrating the ponderous bulk of the sun show no hesitation whatever in going through the solid earth, as they would glass. The stream is always coming through us, always from the direction of the sun.

By the same token, if they are so penetrating, they can penetrate you without having any physical interaction whatever. They are therefore extremely hard to detect. We know they are there: (1) on sound theoretical grounds which have proved themselves for twenty-five years, and (2) for the last two years, by direct observation with a very elaborate type of counter, a liquid counter occupying the space of a good-sized room, which could, very rarely, count an occasional event initiated by a neutrino, one coming not from the sun, but from a more intense source than the sun, namely from the great reactors of the Savannah River plant. These man-made sources are far less productive than the sun, but you can get

within a hundred feet of the Savannah River plant. You can't get that close to the sun, even with the proper sponsorship. The sun is enormously more powerful, but very much more distant. We know that neutrinos are there; they could be identified. One raises a significant question here: should we not look for the cosmic, for the stellar-generated, neutrinos? We should, for they will bring information about the stellar reactions which we could find in no other way. Indeed, since they penetrate so far, so well, it is probable that they will one day bring information from the most remote parts of the universe, farther than we can span with radio or telescope.

The best place for an observatory to study neutrino astronomy, I think, is in the bottom of the sea. Just to confront the paradox, why in such a curious place? Because the bottom of the sea, or more properly, the depths of the sea, a few miles above the bottom and a few miles below the top, is the one place on earth we can reach which is most free of all radioactive processes. The cosmic rays are filtered out by a few miles of sea water above. The activity of the rocks, the radioactivity of uranium in the earth's crust, is filtered out by the miles of seawater below, down to the bottom. The seawater itself is very poor in radioactivity, because the dissolved radioactive materials mostly sink to the bottom very quickly. There in this quiet environment, if we were to place a neutrino counter, which will count only very rarely, will be the neutrino observatory of the future. That future is not far off. It may be two or three years before the first experiments will be underway; slowly we will unscramble the neutrino message which will certainly tell us a very different kind of story than we could possibly learn with those types of astronomy bound to the familiar senses.

One more astronomy to inspect, which again I approach by a familiar path. This is a kind of astronomy which could be understood much better, I expect, out of these mountain regions and at the seashore. The tides are astronomical phenomena too. They are the work of the gravitational pull of astronomical objects, the sun and the moon. Even if we had never had any view of the sky, if we lived shut off deep in the earth, a simple, but precisely operated, device like an ordinary balance is capable of telling us that there exist astronomical objects and how they move. Here in

Figure 10 is a typical example. As you see, it is nothing but a balance counterweighted with springs. It is a very sensitive balance, which takes a very long time to come to equilibrium. Such a slow-moving balance responds, not to accidental vibrations of the case, but much more to the slow-acting forces like those to which the sea responds. The forces that move the sea can move a balance in its case. I cannot describe the matter in detail; but I simply indicate that one uses a type of ordinary knife-edged balance, specially constructed to allow it to respond to very slow influences. You see in Figure 11 the curves which show the rhythm of the tides, as seen in an enclosed balance.

The curves were taken in an upper floor of a hotel in Houston, Texas. Notice the days marked on the graph, the regular rise and fall. These curves can be dissected exactly as the tide curves are dissected for the great ports. From these curves, without ever seeing the stars in the sky, you could learn that we move in an orbit about the sun, that there is a moon revolving about us; you

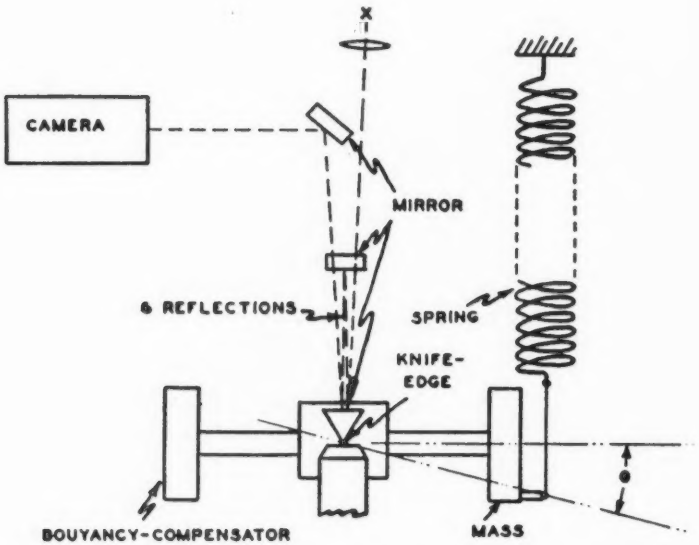


Figure 10—A sensitive balance arranged for measuring very small changes in gravitational force.

could tell what the periods were; and you could make a fair guess at some relations between the masses and the distances. You could thus unravel, so to speak, in darkness a good deal of the dynamics of the solar system.

Now it does not take much effort to believe that if you were to increase this precision by a great deal more than we have yet done, you would "see" not only the sun and the moon, but remote objects. Indeed, not a single object can be in the universe without making its role known in some tiny degree on such a gravitational instrument. This is a study at whose threshold we have only begun to seek entry. We have done only easy things, only what the

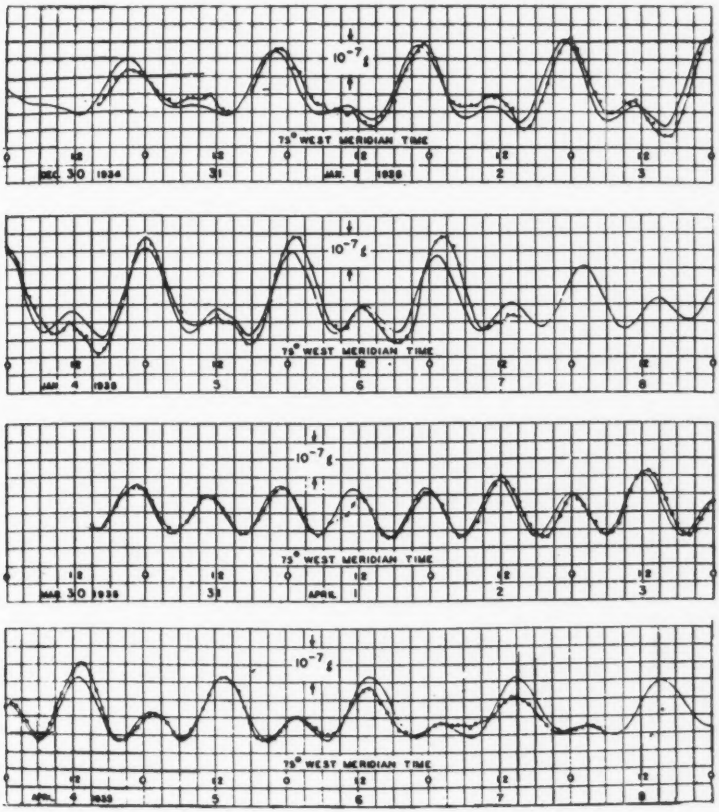


Figure 11—Curves showing variation of gravity seen on the instrument of Figure 10. The effect of sun and moon can be analyzed separately.

tide does. But I think that the next surprises, if they are to come anywhere in physics, are to come in this ancient, and in many ways most difficult, part of physics: the study of gravity and the closely related problems of the study of inertia and of the nature of time and matter itself, which is bound up in this kind of consideration. If we have a very accurate clock—not a pendulum clock but a spring clock, or one run by a quartz crystal, or even by an atom, as the cesium clocks—these clocks too must respond in some minute way to the enormous motions of the great bodies which make up the inertial reference frame, in terms of which our dynamic laws must after all be written. We think they do, but to present accuracy these effects have not yet displayed themselves. I hope that in the next decade or so we will see the first signs of some influence on clocks, on masses, on atoms, of the motions of the very large. Today we are only at the halfway house to that kind of astronomy, to what I may call the inertial or tidal or gravitational or dynamical astronomy. Dynamical astronomy of remote bodies is in some ways the most challenging of all. We do not know yet what the channel may bring.

Finally, I know of one more channel that has just been opened. This channel is a very curious one, because it is analogous to a channel familiar to our senses, and yet it is quite different. We could not detect it. It is what I will call sound, but it is not ordinary sound. A better name for it would be "magnetic sound." Do not confuse it with electro-magnetic radiation. It is the orderly transmission of motion by virtue of the interaction of magnetic fields and material. Electro-magnetic waves—light, radio, etc.—travel even in an absolute vacuum. They need no material medium. Sound waves travel only through matter; but sound waves have nothing to do with electricity or magnetism. But there is a kind of "magnetic sound" in which magnetic force couples to material motion. If space contains both fields and matter, we can expect that space brings us a kind of curious sound along the magnetic lines of force to which we are just beginning to learn how to listen. We "listen" with the compass needle.

Figure 12 will show the behavior of an analog to the compass needle, an amplifier and loop antenna listening not in the radio region but in the very low sub-audio bass region between a tenth and a few cycles per second. We see a few very regular trains of

waves in the antenna, measured in British Columbia a few months ago. These may last for a very long time with their regular behavior. If this is recorded on magnetic tape and played back a thousand times more rapidly, you can hear the analog of what the magnetic needle is doing. What you hear is a rising whistle. Figure 13 shows diagrammatically such a whistle. This is a plot of the frequency versus the time; the frequency rises steadily, in a very orderly progression. We do not quite know what this whistle is due to. Perhaps it is a kind of magnetic sound, transmitted through space to us from the sun, whose turbulent jets rattled against some lines of force which connect our region of the solar system to the sun. Who knows but what there may not be other such lines of force, connecting our solar system with other stars and our galaxy with other galaxies, not over a straight-line path, but over a tortuous magnetic path, along which a subtle message could come by this kind of "magnetic sound." This is another astronomy for the future; it is barely visible in the present.

Here are a set of windows to the sky—six or eight of them. Travel into space may open a few more; but it does not do very much. Once you leave the atmosphere of our earth, it does not make much difference how much farther you go. The stars remain remote, even for the space era today. The windows to the sky, which we can never enter, but only peer through both with our inborn senses and with our man-made senses, will still remain the sources of our astronomical knowledge. There is a great deal still to be learned. We are no longer sure even that the matter we see in all the universe is exactly like our own. To the eye and to the spectroscope, that searching color analyst built on the model of the eye, we find it to appear the same, but is it really the same material Today we have learned of another kind of conjugate matter—anti-matter—which is just like ordinary matter in its spectrum, which would simulate our material to us perfectly while it was buried in remote depths of space—an alien form of matter, just as stable as ours is, but irreconcilable with ours, necessarily annihilating it if ever the two were brought into contact. Such a simple but fundamental point is still unsettled, and only the astronomies which use not light, but the other channels, are capable of solving it. If we could find in a single cosmic-ray particle, a single sample from outer space, the sure evidence

of an anti-atom, we would be prepared, I think, to impute for its origin a whole galaxy—not only a whole star—of anti-matter! When Blake knew how "to see a world in a grain of sand," he was in a way only anticipating the physicist's willingness to follow inference unswervingly to its logical conclusion.

Astronomies span the farthest frontiers. They are the way to insight into the world and, therefore, to the place of man in that world. We know very well that they have their consequences in everyday and practical life. The very energy that drives the stars is now in the hydrogen bomb, the mainspring of war and its fears. Yet it can make the lands rich and peaceful in its future application.

Here is an interesting speculative assumption. Somewhere, gazing through windows of artifice which are like our own, no matter how different the sensory equipment might originally be, there may be those born in space who are not manlike and yet who are our peers. We cannot help hoping one day to encounter them. The further we grow in our probings from dependence upon the built-in senses which are the consequences of our particular environment to those channels which depend upon the nature of the world outside, the surer we become of finding those beings if they exist. Only time can tell; but I think time will tell as all the astronomies, following the ancient models, have developed in their multiple and marvelous channels.

I think it appropriate to close with this very beautiful quotation which is carved into the stately building of the National Academy of Science in Washington, which is an appraisal of this kind of investigation ascribed to the father of the learned, to Aristotle himself, who wrote: "There is a way of learning called science. In that way no one can learn the truth wholly, but yet he will not miss it utterly. And from all the facts so patiently assembled there arises in time a certain grandeur."

Two poems

MARGARET COBB SHIPLEY

BOYS IN THE HOUSE

These warriors, being tireless, invade
Such citadel as we have built ourselves;
The ready truths we munch with marmalade
They scatter at our feet in little halves.
Calling Ho! from battlement and tower,
Down they smash our heraldry with words,
Unhinge our facts, enrage our sleepy hour,
Tease our lazy reasons with their swords.
O brown heads to start so green a war,
Dare your inspirations, ride them high,
Emblazon doubts where definitions are;
We'll sign no truce with treason, you and I.
So long as creeds are stormed and patterns fall,
I'll not be proud, but disbelieve them all.

SONG OF THE MOUNTAIN-MAKERS

Hear my song of laccolith,
Lyre and zither count the tale
Of burned stone in motion now,
Poem of powers primeval.
Ocean interloper, come,
Blue marine millennium!

Richly ored in granite stock
Rise the Rockies to their knees,
Mass Pre-Cambrian to meet
Mingled metamorphoses.
Down uptilted land unloose
Tides, O Late Cretaceous!

High on lava-fractured range
Rides the glacier, changing stream
Cuts the canyon to the plain;
Cirque remains, morainal dam.
Where ocean was, sands follow;
Leave, O sea, your fossils now!

Go, bard, to Niobrara,
Sing, harp, of Gunbarrel Hill;
Music's monument to stone
Be my only madrigal.
Linger, lakes of Laramie,
Coal shall be your gift, O sea!

DECOLLETAGE

By Donald Eastman

"You never know about marrying for love,"
she said, the cool eyes fluttering to ease
while thoughtfully unfingering her glove.
"Yes, a martini, with an onion, please . . .
I had love once. I feel that comradeship
unquestionably is more suitable a guide,
don't you? I hope I haven't made a slip
and given the impression I'm starry-eyed.
I mean, I think that love *can* come to two
who choose wisely to share a mutual flight
guided by more substantial ties. Don't you?"
She moved the coaster a half-inch to the right,
saying, "The ideal romance is so rare—
no matter who—there must be give and take.
Eventually people *can* learn to care
as much as marrying purely for love's sake.
Of course, it *is* desirable to feel
    More than agreement on the latest hat.
        There ought to be a certain—well, appeal.
Why are you smiling at me like that?"

Two high C's

JESSE STUART

"Jason, go see about Sabinah," Ma said. We had just finished eating breakfast and she was looking at the coffee grounds in her cup. "I see trouble, Jason. I'm uneasy about your sister!"

I had seen such a distressed look on her face only once before, and that was when Ambrose Gullet shot my father and killed him over the line fence between our farms.

"Why don't you go, Ma?" I asked.

"I won't go about that eddicated man of hers," Ma screamed. "Never will I darken their door again! He will never have another chance to tell me to leave his house!"

"Can't you send somebody in my place? I don't want to go."

"You are the oldest child! Now that your father is gone, you must take his place to help me get along!"

"All right, I'll go!"

As I walked up the mountain path smoking my pipe, I could hear music in the distance. It sounded at times like a shrill fox horn blowing. I thought how proud Ma had been when Sabinah had married Lockhart. Never had there been a college man in our family. Ma even bragged about Lockhart to her neighbors. Only a two-mile path separated our shacks, but that two miles was like two thousand miles between Ma and Lockhart.

Before I reached their shack, the music had died away. I could hear a man's voice shouting, "What's the matter with you? This is not a guitar and an old dance tune. This is something else!"

I hurried down to the shack and got behind some wahoo bushes in the yard to hear what was going on. When I reached the shack the August sun was just high enough in the sky to start drying dew from the wahoo leaves that I peeped from behind. It was very early in the morning to pay anybody a visit. But I knew Lockhart and Sabinah must have been out of bed for some time. Sabinah was sitting in a straight-backed chair under the apple tree in their back yard.

"I'm too tired to blow in this old flute," she sighed, almost weeping. "I'm too short of breath! I'll never learn to play it, Lock! I don't like it! Why wouldn't a guitar or a five string banjo do as well?"

"That's the way with your people," Lockhart said, pacing over the yard pulling his long hair with one hand and smoothing his short wisp of ripe wheat-colored mustache with his other. "You must learn it, Sab. Our first-born will be here in October! This is the first of August!"

"For six months I've been blowin' on this old flute," she sighed. "Give me a guitar and I'll make it talk. I'll make it cry!"

"Now come on, Sab," Lockhart persuaded her softly, "let me hear you make high C."

It was a strange noise Sister Sabinah made on the flute.

"Oh, my heavens," Lockhart shouted, running circles around the apple tree, pulling his hair. "You didn't even make a note. All you made was a noise! Can't you ever learn music! Will our baby take after the Spradlings? Never go to school? Never know anything but to dig with a hoe on these hills, tote a pistol and shoot? Is that all it will ever know? Wish I were carrying our baby! I'd give it prenatal culture!"

"Prenatal culture, my foot," Sister Sabinah sobbed, gasping with short breaths as she arose from the chair. "I wish you were goin' through with what I am!"

"Ah, sit down, Sab," Lockhart spoke kindly. "Let's give this another try."

"I've stood it as long as I can, Lock," Sabinah said. "Why wouldn't a guitar or a banjo do? And if there wasn't anything to my people, why did you ever marry me? If I'm not good enough to bear your children, why didn't you look around until you found the right person?"

"I did look around," Lockhart replied, his voice softening. "I didn't find anybody in college half as pretty as you, Sab."

As I stood listening to Lockhart and Sabinah from behind the wahoo bushes, I wondered if this foolishness went on all day. I had heard all of it I could stand. I stepped from my hiding place.

"What's all this a-goin' on?" I asked Lockhart.

"I'm glad you've come, Jason," Sabinah said.

"I can't say that I am," Lockhart said.

"Four hours a day on this flute is too much," Sabinah wailed. "I didn't know having a baby would be like this!"

"It shouldn't be like this, Sab," I told her. "I agree with you. A guitar or a five string banjo would do just as well!"

"Mind your own business, Jason," Lockhart warned me. "The law can handle you for coming on our premises to start a row with me when Sab is in this condition!"

"Law, hell," I said, feeling my blood surge through my veins.

"Don't get riled, Jason," Sabinah said. "I don't know what this is all about. Maybe Lock is right. Maybe the flute is a better prenatal instrument than our kind of music!"

Lockhart looked hard at me as he shoved his long blond locks back from his forehead, then he said, "Jason, if you were a married man and your wife was going to have a baby, you would have her out shooting at a mark on a tree! You would have her throwing a knife with a long blade trying to stick it into a tree! That's why the Spradlings are such good marksmen and so handy at knife throwing."

"That's a bare-faced lie," I told him.

"Leave my house!" little, weakly Lockhart raved, waving his thin white hands high in the air. "Clear out! Tell that mother-in-law of mine to stay away, too!"

"Don't go, Jason," Sabinah said as I turned to walk away. "You don't have to go. This is my house too! And you are welcome!"

I didn't argue with my brother-in-law, Lockhart. He might get an indictment for me for coming to his house and startin' a row. I thought my sister Sabinah was a pretty girl. She could have married a handsome man among the people of our kind who liked our songs, our music, and the kind of instruments we liked to play on. She didn't get no bargain in Lockhart Remington, this wild-haired, flute-playing college man.

Sabinah was tall with blue eyes, light brown hair, and perfect teeth. No wonder Lockhart had married her, even if Ma had never seen a flute before she was born. Ma's prenatal culture had been in the cornfield two hours before Sabinah was born. She barely had time to leave her hoe in the field and get to the house to have Sabinah. Ma got the name for her off of an old tombstone in the Granny Thomas Graveyard on Dummitt Ridge. I left

Sabinah crying as I took the path for home to tell Ma how things were going.

"Now come on, Sab," I heard Lockhart persuading her when I was a half mile away, "let's have a high C!"

"How was Sab?" Ma asked soon as I got home. "Did she look well?"

"Not too well," I said. "I don't know much about women, but I believe her baby will be here before October."

"It's her blowing on that blasted flute," Ma screamed and shook her fists at the wind. "I believe Lockhart is teched shore as the good Lord made little green apples. Yesterday, when I was on the mountain side a-huntin' for pawpaws, I saw Lock and Sabinah down in the cove. He was playing his flute to the crickets, lizards, terrapins, katydids, and grasshoppers. Sabinah had her head thrown back and wasn't listening. That wasn't her kind of music. They didn't see me, but I saw them down there. I heard the flute, and I slipped through the brush and watched 'em. I felt like going down and getting my hands in that Lock's long hair!"

Ma had too much pride ever to go back to Sabinah and Lockhart's shack after he ordered Ma out. I couldn't go back after he had told me to get out once. I knew I would have to fight him if I ever went back and he started that stuff with me again. But many times when I went up on the mountain to get a pole of stovewood, I heard him playing his flute for Sab. Much as I hated him and his flute, I'll say he could play some pretty tunes. I could hear his tunes above the evening calls of the whippoorwills, the grasshoppers, crickets, and katydids. All through August, I had sat many evenings under the trees, far away from Lock and Sab's shack, and listened. But I didn't listen four hours every morning when he drilled Sab on the flute! But I could have sat that long listenin' to her play her banjo or guitar before she married Lockhart, this high school music teacher and band leader. Back in those happy days, my sister and I went to square dances with the people of our kind. We had a good time dancing to the fiddles, guitars, and banjos all night long.

August passed and September came. Our people everywhere among the mountains were talking about what Lockhart was doing to Sabinah. There were many who liked our kind of music who thought about brush-whippin' Lockhart for the way he was

trying to teach Sabinah this flute music when the time for her baby to come was so near. These were our mountain people who didn't understand this prenatal culture. Besides, they could see what the flute was doing to Sab with time of delivery so near at hand. They had seen her and had told Ma and me how her jaws were puffed out like a blowing viper's when it licks its tongue out and hisses in its harmless way to scare you. They told us how the veins stood out on her pale neck like swollen tomato stems. The neighbors said something would happen to Sabinah if she went on blowing that old flute, and it would be Lockhart's fault.

In September when the sassafras leaves on the slope started turning, we saw Dr. Charlie Conley drive past our shack up the winding road between the high slopes. Lockhart was sitting beside Doc in the big car as he whipped it around the bends and over the chug holes.

"I'll bet Sabinah's havin' trouble," Ma said, watching the car fade before the clouds of white soupbean-colored dust. "I told Sabinah while she was still in the nest and under my wing that if she sat down on a hot griddle and blistered herself she'd have to sit on the blister. I mean what I say. I'll never darken Sabinah's door again what time I live."

"But Sab's my only sister," I said. "I'm going to see what's wrong! Lock told me to get out of his house and stay out, too! But Sab's my sister, and I'm goin' there now!"

Before I reached the shack, I met Doc Conley racing his car toward town. He passed me like a big, slow, curving bullet in swirling clouds of dust.

"What's wrong, Lock?" I asked before I got to the shack.

Lockhart was running his long fingers through his rumpled hair. He was moaning something I could not understand as he ran around the house as wild as a rabbit. He never answered me.

"What's wrong, Sab?" I asked when I ran inside the shack.

Sabinah was lying in bed under a thin sheet, moaning and grumbling in her uncomfortableness.

"Too many high C's, Jason," she moaned.

"Where's Doc Conley going, Sab?"

"After the ambulance to take me to the hospital," she said, with short breaths. "I'm afraid I'll never get back alive."

"You have a chance to live, Sab," I said to comfort her.

"Go to the hospital with me, Jason," she begged. "You are practical. Will you go?"

"Sure, I'll go!"

"I want some of my people with me," she sighed. "I know Ma won't come."

"No, she won't come," I said. "She's sore enough at Lock to wring his neck."

Lock never came inside the shack. He often passed the door and looked inside. He stared at the clabber-milk clouds floating across the sky and mumbled strange words I still couldn't understand. He was an educated mountaineer and could speak German, French, and Spanish. I think he was talking to himself in one of these languages. I know he was speaking in a language I didn't understand.

"When was the last time you blew on that flute?" I asked Sabinah.

"This morning," she whispered, "and I almost went blank. I almost collapsed!"

"That damned fool Lock," I said.

"I'll never be able to blow it again until it happens, Jason," she whispered. "I've got just enough breath to keep me goin'."

I thought Sab was dying when we put her in the ambulance. Ma was on the porch to see us pass. I sat in a small chair beside Sab. Lockhart rode in the front seat with the driver and he'd forgot and brought his flute along. He was still talking to himself in a strange language. Once, the driver told him to shut up before he made him wreck the ambulance. He took us slowly over the rutty road to the highway and then we streaked over the moonlit road with our siren screaming for cars to get out of our way. At midnight we reached Mercy Hospital at Maitland.

Hospital attendants rushed Sabinah to the delivery room. Lockhart didn't go into the hospital with Sabinah. I watched him take off toward Maitland City Park with his flute in his hand. I thought the midnight sleepers in Maitland would, perhaps, dream peacefully to Lockhart's music.

"Stay with me, Jason," Sab said, holding to my hand. "Remember the days we've played together?"

"I'll stay with you," I told her.

"Where's Lock?"

"Took off with his flute," I replied. "He went toward the Maitland City Park."

"Oh, don't mention that flute," Sab sobbed.

I waited outside of the delivery room. I didn't know what else to do. I wasn't married. I had never been around where babies were born before. I waited for some answer. Soon, a strange doctor dressed in white with short sleeves, with only his dark eyes looking at me from behind a white mask, walked up and said, "To save your wife, we think it is better to force the baby. Is it all right with you?"

"Go ahead and do what is best for her," I told him.

Before I could tell him that I was her brother, he was back in the delivery room. I hardly knew what I was doing as I paced up and down the corridor outside the delivery room. Minutes dragged into hours.

At daylight, the doctor came out of the delivery room.

"What's happened, Doc?" I asked.

"Congratulations! Twin boys!" he said. "And your wife is resting easy."

I didn't know what to say. I couldn't say anything. I couldn't tell him that Sab was my sister and that at this very moment I heard Lockhart somewhere in the City Park blow two high C's on his flute.

Musee des beaux arts

FREDERICK EBRIGHT

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The God of fiction

CHARLES I. GLICKSBERG

The contemporary artist, though he must take upon himself the metaphysical burdens of his time and struggle to solve the supreme enigma of life, cannot afford to concern himself with theological doctrine or questions of religious orthodoxy, for he lives in an age that is predominantly secular in outlook. Since he cannot depend upon a common background of religious values, he must remain spiritually uncommitted to any hard-and-fast dogma. The death of God that Nietzsche triumphantly proclaimed has had a disruptive influence on the unity of Western culture. New ideals of conduct and new bonds of unity have had to be found. Especially in literature has this meant not only a radical break with the traditional assumptions of the past but also a fundamental reconsideration of the spiritual bases of the writer's vision, his universe of values. The modern novelist has often been compelled to operate in a kind of philosophical vacuum, to wander in a desert where he is not only lost but doomed to suffer unquenchable thirst and ultimate defeat. Hence he searches desperately for a principle of meaning, a light that will shine through the darkness. His quest for salvation is, however, a bitter and desolate one, not only because it takes place under secular auspices but also because at heart he does not believe that salvation is possible for man. T. S. Eliot, in *The Waste Land,* poignantly foreshadowed the spiritual dilemmas and distresses that serious-minded writers in our century would have to suffer as they sought guidance and fulfillment in a culture ravaged by the blight of skepticism.

The alienated novelist of our time thus faces a staggeringly difficult challenge. First of all, he dwells in a climate of thought which has done away with the trappings of the supernatural. Once the Christian mythos loses its efficacy as an object of absolute faith, then the supernatural becomes merely a literary property, a fruitful symbol, but no more than that, for imaginative elaboration.

No writer who has been exposed to the work of Vico, Darwin, Nietzsche, Freud, Dewey, Einstein, Karl Marx, and Bertrand Russell can hope to recapture the old purity and passion of faith in the supernatural. What is more, the modern writer has lost his reliance on the absolute. Even the struggle of Existentialist thought in its mystical affirmation, the revival of interest in the work of Kierkegaard, the contributions of the theology of crisis, serve to reinforce the impression that doubt in our age is pandemic. If skepticism, according to Santayana, is a form of belief, then even skepticism has ceased to be affirmative and creative. Even the cataclysm of war, the prospect of global disaster, the apocalyptic agonies of our time, cannot restore the certitudes and intensities of the religious synthesis of the past. Whatever functional relationship may obtain between literature and belief, it is obvious that the writers of our day have been profoundly affected by this ideological revolution. The earnest attempts of Christian apologists to revive the faith and make it impregnate the current body of literature have not borne much fruit.

One of the crucial problems for writers of our time—it is also an exceedingly complex one—is to determine how the ingredients of belief enter as a shaping force into the making of literature, assuming for the moment that they do so enter. Is a literary work—a novel, a poem, a play—to be judged by its degree of conformity to the spirit of a particular faith, or is the religious belief that the writer happens to hold irrelevant to the assessment of the value of the work he produces? Obviously no novelist sets forth his religious convictions in a straightforward, categorical manner, within the framework of fiction. The matter of belief clearly involves more than a question of theological uniformity. Essentially the writer is faced with an aesthetic rather than theological problem, for form cannot be separated from content. For example, which of the beliefs that emerge in a novel genuinely belong to the writer and represent his own outlook on life?

Contradictions inevitably arise when the critic tries to use a religious or moral yardstick in appraising the value of a literary work. Frequently the novelist may be giving expression to the tumultuous conflicts of his age, the confused aspirations of the people he is writing about, the values they live by, the truths they cherish. He is not necessarily embodying his own religious in-

sights. Moreover, his characters, if they are truly alive, are autonomous creations, moved by an inner life of their own. Hence there is little validity to the argument that the novel has its roots in religious belief, even if it be studied for its unconscious motifs and indwelling symbolism. Certainly there is no correspondence, in the realm of fiction, between "correctness" of belief and literary greatness. Some religious-minded critics, however, insist that the writer's attitude toward life, the beliefs that control his thought and behavior, are bound to flow into his imaginative activities, his vision, his use of language. That, in brief, is the thesis Martin Jarrett-Kerr defends in *Studies in Literature and Belief*. But if that is the case, then we are fairly certain to discover that the concept of God, embodied as an object of belief, symbol of a collective state of mind, has undergone a thoroughgoing transformation. As mirrored in the fiction of the present, man has usurped the throne of God. Therefore, whatever religious values penetrate this man-centered vision of life are bound to be critical of traditional religion.

We are forced to assume that this transformation of consciousness, this drastic revision in the interpretation that writers give of their world and of life as a whole, constitutes a "religious" reorientation that is basically different from the religious consciousness that prevailed in the past. The writer has not, of course, abandoned his reliance on the divine absolute without a struggle; the abandonment has been attended with intense suffering; it has made him suffer from what William James calls a "sick soul." For his present attitude toward the universe has been shaped decisively by his awareness of the disastrous role evil plays in the world. Unable to turn his eyes away from the iniquities and abominations of existence, he has in many instances become convinced that evil is the very essence of life. How then reconcile this hideous outcropping of evil with the teachings of religions? If God is responsible for the creation of the world, then He is also the author of evil. If God is indeed supreme, all-powerful, and all-knowing, then how can He be absolved of blame for allowing the plague of evil to infect life? The writer perceives that everything turns to dust, and death is finally the victor. The smell of the charnel-house pervades all of existence. Now that faith has fled, man suffers on earth without meaning or purpose. In a universe stripped of

meaning and a sense of ordered unity, the writer is afflicted with fear and trembling, consumed by a metaphysical melancholy which, in its extreme form, turns into positive anguish. The world, lacking a foundation of meaning, becomes alien, uncanny, hostile, unbearable. The spiritual basis and continuity of life is destroyed.

For example, Tolstoy, when he faced this crisis of faith, saw no reason why he should go on living. The fact that he could find no satisfactory answer to the questions that tormented him filled him with the fury of despair. In a number of key passages in *War and Peace*, his two principal characters, Andrew and Pierre, speculate on God, fate, free will, death, and the meaning of life. Pierre, after wounding Dolokhov and parting from his wife, is plunged in painful reflections of his own, eager to solve the enigma of existence. What, he asks himself, is good and what is bad? What does one live for? "What is life, and what is death? What power governs all?" The only reply he can make at this juncture is that death will come and end everything. Here are the questions which precipitated Tolstoy's own spiritual crisis.

Dostoevski's main characters, rebels seeking a solution to the riddle of the sphinx, stand accusingly before the bar of life. Nothing will stop them from revolt. Either-or! Life is a phantasmagoria of illusions, or God and the Kingdom of Eternity are real. Dostoevski presents this dilemma in passionate, concretely human and imaginative terms. If life is indeed absurd, if God, like immortality, is a pathetic dream of wish fulfillment, then why not condemn nature and end it all? Why not commit logical suicide as an act of revenge? That is what animates Kirillov in *The Possessed*: he takes his life because he is possessed by an idea. If God does not exist, then he is god. But God does not exist; it is all an illusion, a lie; therefore, he must demonstrate this redemptive meaning by killing himself. His "mad" reasoning illustrates the excruciating dilemma of the man who must bear the burden of life in a universe without God. That is Kirillov's madness and yet he is not mad. His freedom, his godhood, lies in asserting his independence, in ceasing to serve any divine being. By slaying God, he usurps His power, and he kills himself in order to liberate man from the thralldom of hope. Paradoxically enough, it is out of love for mankind that he takes his life: he will point out the way

—the goal of death that leads to nothingness. He is, in a sense, the first Existentialist hero. Dostoevski, of course, shows that his satanic characters, his rebels against God, are defeated. An Existential novelist, Dostoevski embraces Christian mysticism, but the dramatic tension present in his work arises from this very conflict over the existence of God. As a great imaginative artist, Dostoevski sympathized strongly with the blasphemers, the diabolists, the nihilists. Indeed, his main characters suffer from this metaphysical torment of doubt, the compulsion to negate the absolute, the contradiction that is at the heart of life. At the end he offers a Christian solution, a stake in the future life, but even as he roots himself fervently in the soil of faith he cannot rid himself of the sacrilegious doubt.

Dostoevski believed in the reality of the divine, but what kind of religious vision can the modern writer call forth when he lacks the conviction to believe in the destiny of man. He cannot believe and he cannot even affirm that in which he does not believe. That is the nature of the nihilistic trap into which he has fallen. Having eaten of the apple of the tree of Freud, he assumes that religion is a kind of mass delusion. Religion, a product of wishful thinking, is thus nothing but a transitional stage in the course of human evolution. Freud challenged the basic assumption of religion that it could afford man any measure of protection against the cruel winds of adversity; the good are not rewarded for their pains nor are the wicked punished for their sins. No providential power is at work, presiding over the universe and keeping a strict moral account of every thought and deed of man. The brute powers that determine human destiny care nothing for human happiness. Freud believed that religion would be abandoned when its fantastic claims ceased to gain assent. He envisaged the eventual triumph of the intellect over instinct, reason over superstition.

Once God, the anthropomorphic deity who took heed of the fall of every sparrow, is acknowledged to be dead, then man can no longer live in the light of eternity. Henceforth, caught in the trap of time, he remains a dweller in the realm of history, which is secular, brief, and precarious. He is thrust into an existence that he cannot, try as he will, endow with meaning; though given the freedom to choose, he is nevertheless doomed to die. Consequently he can discover no sound reasons why he should commit himself

to any established system of morality. He is "free," beyond good and evil, not to be fooled by collectively sanctioned dogmas and superstitions. If there is no God and no assurance of life in the hereafter, then as Dostoevski maintained, everything is permitted, all ethical restrictions are null and void. Aldous Huxley and Andre Gide portray characters who kill without compunction because for them there is nothing sacred in life.

Thomas Hardy, both in his poetry and fiction, anticipated many of these contemporary problems that spring from the dissolution of the traditional faith. Throughout life he stubbornly clung to the conviction that the Supreme Mover or First Cause (which in *The Dynasts* he designates as It) is either limited in power, unknowing, or cruel. Like Freud, he could not conceive of a morality, benign or malevolent, associated with Nature. Concerning Nature, he argued, only two conceptions could rationally be held: either she was blind and not aware of what she was doing or else she was an automaton and therefore not responsible for her actions. Hardy never surrendered his belief that the Cause of Things, however constituted, was neither moral nor immoral but unmoral, knowing neither love nor hate, neither good nor evil.

The consequences that flow from adhering consistently to such a position are not hard to visualize. If man perceives no purpose in living, then his individual life becomes badly disorganized, for there is no controlling principle to motivate his behavior and lend meaning to his multifarious activities. Hence the death of God has given rise to the metaphysics of absurdity that is so bizarre and disheartening a manifestation of the failure of faith among contemporary writers. For their indictment of the universe, despite the ingeniously stoical arguments advanced by Camus in *The Myth of Sisyphus*, represents an unconscious will to die. Certainly their creative energies are bound to suffer arrest, for a life that is rooted in disgust and despair and ruled by a sense of pure contingency can neither affirm nor achieve the perfect work that is destined to last. By losing his faith in God, contemporary man has, alas, also lost faith in his own reality. What does his declaration of freedom amount to but a dreadful awareness of the nothingness that hems him in on all sides. The Existentialists, like Heidegger, realizing the inevitability of death, are resolved to learn how to live with nothingness; alone in the void, they look upon existence

as an utter absurdity, a useless passion. This is the anxiety neurosis, the metaphysical nausea, that has been brought about by the passing of the gods.

Though there are signs of a spiritual revival in contemporary letters, the religious consciousness, at least in its traditional form, seems to have largely disappeared. Whereas the medieval order believed in reason as the foundation of faith, the present age, as portrayed by its literary spokesmen, is utterly without faith, but its deification of reason has also been shaken. Few intellectuals now cherish a faith in salvation to be achieved exclusively through the instrumentality of reason and the scientific method. But this recession, this disenchantment with the utopian dream of perfection through Marxist or scientific or technological coordination, does not mean a precipitate return to religious orthodoxy. Few writers today believe that the world was created by an intelligent being or that morality is of universal validity. But the life of man still remains very much of a mystery; there is the riddle that none of the sciences can solve. The reality of a man's life cannot be imprisoned in fixed discursive categories. This is the implicit metaphysic that underlies the work of many contemporary novelists. As D. H. Lawrence said: "Because a novel is a microcosm, and because man in viewing the universe must view it in the light of a theory, therefore every novel must have the background or the structural skeleton of some theory of being, some metaphysics. But the metaphysic must always subserve the artistic purpose beyond the artist's conscious aim." For life is fluid, various, dynamic, constantly changing, and cannot be pinned down to some theological absolute.

If the minds of men are busy formulating a cosmology that is naturalistic and secular and relativistic in orientation, then the novelist, if he is to give a faithful report of the groundswell of opinion and belief in his time, must take cognizance of this rise of secularism and reflect it in his work. Even if, like Graham Greene, rooted in Catholicism, he must of necessity reveal the feverish spread of irreligious thought. Theodore Dreiser, from the beginning of his career (*Sister Carrie* was published at the turn of the century) to the very end, was a militant naturalist, exhibiting the vast cruelty of nature, the blind indifference of the universe to the aspirations and ideals of man. In *Of Human*

Bondage and in his literary autobiography, *The Summing Up,* Somerset Maugham describes how he gradually threw off the trammels of orthodoxy and came to espouse a hedonistic system of ethics that had no room in it for the concept of God. In his early astringent satiric novels, particularly in *Antic Hay,* Aldous Huxley gives voice to the skepticism and even cynicism of a generation in revolt against Victorian moral absolutes. But Huxley for one was soon spiritually dissatisfied with playing the role of an ironic relativist.

Eyeless in Gaza marks a sharp transition in Huxley's philosophy of life. The chief character in this novel is in the end converted to a form of Buddhist discipline. Huxley has at last hit upon a theme that calls forth his deepest aesthetic response: his awareness of the brevity of time, the precariousness of life, the ultimacy of death. He has arrived at the final stage of his mystical journey, and now preaches earnestly that before one can gain the liberating knowledge of God, he must throw off the bondage of selfhood. The way to achieve oneness with God is to repudiate this preoccupation with the private and possessive ego. Unfortunately, Huxley goes so far in his rejection of purely human values as to wind up by abolishing them completely, for in the light of eternity and the unitive knowledge of God of what importance are the frantic struggles of mankind, the agonistic conflicts of history? In short, Huxley has become a seeker after religious unity, though, as is evident in *The Perennial Philosophy,* he does not embrace a single creed but eclectically selects the best that mysticism, of all ages and races, has to offer. It is his repudiation of history, of human concerns, and of the dimension of time, it is this very vision of an abstract God and of eternity as Nirvana, which has led one critic, D. S. Savage, to condemn Huxley's mysticism as fundamentally atheistic. Huxley seems to believe that God is completely present only when what we call our humanity is completely absent. In *Time Must Have a Stop,* the same thesis is stressed: self-will must be sacrificed to make room for the supernal knowledge of God. One must rise above the expedients of Nation, Class, Party, Culture, and even Art. The paradoxical upshot of this obsession with the unitive knowledge of the divine Ground is that the mystic loses all interest in and all desire for art. Huxley as a novelist has thus become a "religious" propagandist, and his fiction is intel-

lectual rather than dramatic in structure. He has ceased, in fact, to be a novelist who delights in sensuous observation, beauty of form and style, the vigorous exercise of his sensibility and imagination. A novelist who sets out to annihilate the personality destroys the very source of his creative power. If life is a cheat and the self a snare and human activities a pathetic illusion, then what earthly justification is there for the production of art?

Huxley illustrates the supreme difficulty faced by the novelist who, having turned mystic, seeks to communicate the incommunicable, but he is not in the main tradition of contemporary literary thought. A more representative and vastly more disturbing figure is Albert Camus, whose novels introduce us to heroes who confront life and the desperateness of their situation without the illusions of religion. Strangers in this world, they march, lonely, alienated, and doomed, on this journey to the end of nothingness, deprived of moral will or the capacity to feel. When the protagonist in *The Stranger* is thrown into prison, society tries to get him to repent, to believe in God, but he is not interested. The problem, significantly enough, that continues to plague him is how to kill time. Perhaps the most powerful scene in the novel is the one in which the priest comes to convert him, but he angrily rejects all that the priest has to offer: the mercy of God or the promise of salvation. After death, he informs the priest, there is nothing; though he has often wished there would be an afterlife, he places no trust in such fantasies. When the priest persists in his ministrations, the hero goes berserk and violently repudiates the truth of religion. Nothing is of any importance, neither life nor death, neither love nor God. Everyone would one day be condemned to die; no one would escape. Since that is so, nothing matters; death annuls all obligation.

In *The Plague,* Camus confronts this problem of faith and meaning more realistically. Once the plague strikes, the inhabitants of the town are forced to take stock of themselves, to consider the significance of time and the meaning of their life. Each one seeks to discover the cause of this catastrophe. Father Paneloux preaches a sermon charging that the pestilence is a kind of retribution for the sins of the people. Doctor Rieux, however, has no patience with this hell-and-brimstone sermon that maintains there is some good in this plague; the same argument could be ap-

plied to all the ills and evils that human flesh is heir to; there is no good reason for giving in to the plague. But since the Doctor does not believe in God, why does he devote himself so self-sacrificingly to the care of the stricken? His curiously revealing reply is that if he believed in God he would stop curing the sick and leave all that to the acts of God. As a doctor he feels it is his duty to do what has to be done. Since the order of the world is shaped by death, he reasons, "mightn't it be better for God if we refused to believe in Him and struggle with all our might against death, without raising our eyes toward the heaven where He sits in silence." When he watches the suffering of the magistrate's boy, he wonders, Job-like, how God can justify such suffering or how man can be reconciled to it. Father Paneloux, however, concludes that suffering is a test of human faith. One must believe everything or deny everything, and who would dare to deny everything? All or nothing! Father Paneloux, consequently, is prepared to believe everything in order not to be thrust into the awful predicament of denying everything. One must either hate God or love God. That is the terribly difficult yet unavoidable choice: if an innocent child loses his life, a Christian must either give up his faith or endure with God to the very end.

That this dramatic portrayal of a conflict in values is consistent with Camus' philosophy is borne out by the ideas he advances in *The Rebel.* The metaphysical rebel is the man of our age who protests against the universe, against a type of life that he finds intolerable. He rebels in behalf of a dream of order, a higher value, the reign of justice. He protests against the needless suffering that life imposes and above all he wages war against death. But the blasphemer, even as he curses God, acknowledges His existence. Yet even if God existed, He would remain useless, for men could not believe in Him. The rebel, in engineering a metaphysical revolt, is thus guilty of satanic defiance. "When the throne of God is overthrown," Camus declares, "the rebel realizes that it is now his own responsibility to create the justice, order and unity that he sought in vain within his own condition and, in this way, to justify the fall of God." This is the realization that ushers in the bloody rule of man.

The novelist who is a "rebel" by conviction can, like Camus, capitalize on the tensions and contradictions that his rejection of

God entails. For a novel cannot be born out of conformity; it must be charged with heresy and conflict. Graham Green, in *The End of the Affair,* seeks to develop the religious motif by contrasting it with the theme of erotic attachment. The woman in this novel at first does not believe in God, but when the one man she truly loves is, she thinks, hit by a bomb, she kneels on the floor in prayer. The author vividly describes her intense struggle to gain faith. She makes a kind of compact with God that if her lover is spared, she will give him up forever. Her aim, after this crisis is over, is to escape the tyranny of the flesh, to get rid of the body and its appetites. Thus the Resurrection seems an absurd fantasy. Nevertheless, despite the absurdity, she is drawn to a life of absolute faith. The last letter she wrote before her death reveals the conflict in her nature. Like most people, she wants both eternity and the specious present, both God and human love. In spite of everything, she is ready to believe, even miracles, in the face of scientific refutations. "I've caught belief like a disease," she writes. "I've fallen into belief like I fell into love." And the lover, despite himself, is changed by this "affair," for it forces him to wrestle with the enigma of death. If death is the end of everything, then why struggle to create? If immortality is real, then his preoccupation with art and love is foolish and irrelevant. Greene broods curiously about the beginning and end of things, both of which are mysteries. "When we get to the end of human beings," he reflects, "we have to delude ourselves into a belief in God. . . ." It is evident that Greene is willing to run the danger of falling into heresy rather than falsify the picture of life he draws.

Here we observe how a Catholic novelist uses doubt and heresy to add complexity of conflict to his fabric of fiction. The Existentialist writer, however, breaks entirely free of the Hound of Heaven. Richard Wright, for example, a Negro novelist, is heavily indebted, in *The Outsider,* to the work of Camus and Sartre. Here he sharply poses the question that Camus sets forth so challengingly in *The Rebel*: What is to become of the uncontrollable will to power if man seriously strives to become God? Such a usurpation inevitably culminates in moral nihilism, in an absolutist worship of power. Nihilism ushers in a climate of terror, a nightmare of inhumanity. Wright's Existentialist hero, obsessed with anxiety, feels insulted at being alive, humiliated by the con-

dition of existence. He asserts his freedom—the familiar Existentialist strain—in a world that is no longer supported by supernatural sanctions; he accepts full responsibility for all his decisions. He endeavors to answer in new terms the age-old question: What is man? Consistent in his philosophical conclusions, he suspects that the metaphysical terror, "the nausea," man experiences is born of the dismaying perception that man "is nothing in particular."

Thus we are introduced to a criminal hero who, in rejecting moral and divine law, recognizes the nothingness of man. He has become the source of his own values, his own god. Whereas in the past primitive man projected his myths so as to reconstruct the world around him in the image of desire and thereby overcame his abysmal fears of the menacing darkness and the unknown, so even today twentieth-century man seeks to disguise the unbearable truth of reality and hide behind the consolatory myths of religion. Man, in short, needs the solace of the absolute lie. As Wright's protagonist points out: "We twentieth-century Westerners have outlived the faith of our fathers; our minds have grown so skeptical that we cannot accept the old scheme of moral precepts which once guided man's life." Here we have brought into the open the irreconcilable conflict between reason and faith, atheism and the inexpugnable need for belief in God. For, as Dostoevski insisted, if the supernatural is completely overthrown, then man is hurled into nothingness and life becomes intolerable. The consequences of atheism must be realistically faced. Living their life on the assumption that there is no God, the atheists discover that the implications of such a *Weltanschauung* are nothing less than catastrophic. "It means that God no longer really concerns us as a reality beyond life, but simply as something projected compulsively from men's minds in answer to their chronic need to be rid of fear, something to meet the obscure needs of daily lives lived amidst strange and threatening facts." Though the religious compulsion is still powerful and affects practically every human activity, men can no longer confidently define the goal toward which they are striving. For if man no longer places his trust in God, then, as Wright's hero points out with unflinching logic, man can do very much as he pleases on earth. All higher laws, all moral restraints, are rendered invalid. Here is a character, then, an out-

sider, who has cast off the bonds of marriage and children and love and friendship, a man without a party or tradition, without culture or myth or faith, incurably skeptical and defiant, nourished on the work of Nietzsche, Jaspers, Heidegger, Husserl, Kierkegaard, and Dostoevski.

The formidable problem the contemporary novelist faces is how to shape his life and work in a universe that is no longer seen (seeing is believing) as created and controlled by God, but obviously human existence on such terms, without religious commitments, without an ultimate aim justified by God and His promised kingdom of eternity, becomes meaningless. In the name of what purpose shall the writer dedicate himself to art? For the coming generations of man? But they, too, shall turn to dust in the endless cycles of birth and death. If the novelist is genuinely convinced of the essential absurdity of existence, for the individual as well as the race, then what incentive can he summon forth to sustain him during the trying ordeal of creation? If life is judged as inherently absurd, then it follows that art, too, is an absurdity, for without reference to the eternal all activity is steeped in the absurd.

Albert Camus tries to solve this problem aesthetically by arguing that the godless man as artist is not concerned to explain, to solve mysteries, but to experience all things given. The novelist describes, he does not justify the universe that is both inexhaustible and inexplicable. Camus, it is clear, does not shrink from the disastrous consequences of his philosophy: art is a manifestation of the absurd, and so is his book, *The Myth of Sisyphus,* demonstrating that art is absurd. Contemporary fiction reflects the metaphysical sickness modern man suffers from, but at least it enables the writer to get outside of himself and to view the human plight clearly. Yet the question remains: is an absurd work of art possible? For nothing is fundamentally changed by the act of creation. How can the novelist continue his work without hope, laboring, as it were, in a vacuum? Camus writes uncompromisingly:

> I want to liberate my universe of its phantoms and to people it solely with flesh-and-blood truths whose presence I cannot deny. I can perform absurd work, choose the creative attitude rather than another. But an absurd attitude, if it is to remain so, must remain aware of its gratuitousness. So it is with the work of art. If the commandments of

the absurd are not respected, if the work does not illustrate divorce and revolt, if it sacrifices to illusion and arouses hope, it ceases to be gratuitous.

That is the last line of defense held by the novelist who is wedded to the philosophy of nothingness. He must resist the temptation to judge and yet still keep faith with the principle of the absurd. But in renouncing, as indeed he must, the last illusion about life, does he not involve himself in a suicidal contradiction? The novelist of today does more than tell stories; he creates his own universe and the great novelists of our time are therefore philosophical novelists, even though they do not reason or argue. The work of fiction represents an unvoiced philosophy whose implicaitons are apparent in every part of the structure and content of the novel. But if the novelist, whatever attitude he embraces, rests inevitably in illusion, then it follows that the metaphysics of absurdity may also represent a time-bound, ephemeral illusion. If he keeps rigorously to the canons of logic, if he acts consistently on his fundamental assumption that the universe is void of God and meaning, then he must finally, like the saint, wind up his career by renouncing the life of art. There is no future for a literature of absurdity.

authors

(Continued from page 116)

MIREILLE BABAZ and ALFRED FONTENILLES ("The Lesson of the French Crisis," p. 165) were among a group of French teachers who spent five weeks this past summer at the University of Colorado on Fulbright-Smith-Mundt Fellowships. Both have studied in England as well as France. Miss Babaz teaches at the Lycée du Raincy, Paris; Mr. Fontenilles, at the Lycée Jacques Decour, Paris.

PAUL PETRIE ("After a Trip to the Art Museum," poem, p. 172) received his Ph.D. degree from the State University of Iowa. He spent the past year on the island of Majorca. His poetry has appeared in *New Campus Writing No. 2, New Yorker,* and numerous university reviews, including the Autumn (1955) and Winter (1957) issues of *The Colorado Quarterly.*

PHILIP MORRISON ("Windows to the Sky," p. 173), Professor of Physics at Cornell University, was with the Metallurgical Laboratory at Chicago, which made the first nuclear pile, went then to Los Alamos, and was in charge of the design of the world's first fast-neutron chain reactor. His article was originally one of the 1958 Summer Lectures in the Sciences given at the University of Colorado.

MARGARET COBB SHIPLEY. ("Two Poems," p. 195), Boulder, Colorado, novelist and poet, also assists her husband in his operation of Shipley Press. As a result of her work with William Barrett at the 1957 Writers' Conference in the Rocky Mountains, Mrs. Shipley's novel, *The Sound of the Sun,* was published in August, 1958, by Doubleday. Her first poetry sale was to *The New Yorker.*

DONALD EASTMAN ("Decolletage" poem, p. 197) has held promotional and editorial posts with Curtis Publishing Company, *Woman's Day,* and *Printers' Ink.* Since he began devoting full-time to free lance writing two years ago, his articles, stories, and poems have appeared in *Author & Journalist, Southwest Review, New York Times, New York Herald Tribune,* and *Beloit Poetry Journal.*

JESSE STUART ("Two High C's," p. 198), well-known Kentucky poet and novelist, has written nineteen books, the latest being *The Year of My Rebirth,* published in 1956. His poems have appeared in a wide variety of periodicals, including the Spring (1957) *Colorado Quarterly,* and in three volumes, *A Bull Tongue Plow* (1934), *Album of Destiny* (1944), and *Kentucky Is My Land* (1952).

FREDERICK EBRIGHT ("Musée des Beaux Arts," poem, p. 205) has had poetry published in *Atlantic Monthly, New Yorker, Saturday Evening Post,* in eastern newspapers, in anthologies, and in many university reviews, including the Summer (1957) *Colorado Quarterly.* His first book of poems, *The Various Years,* was published last year (Triangle Publishing Company, Dallas, Texas).

CHARLES I. GLICKSBERG ("The God of Fiction," p. 207) is Professor of English at Brooklyn College and a member of the faculty at the New School of Social Research. He is the author of *Writing the Short Story* and *Walt Whitman and the Civil War* and the editor of *1950 American Vanguard* and *American Literary Criticism: 1900-1950,* collections of short stories and critical essays respectively. His work has been reprinted in *Twentieth Century English, Modern Omnibus,* and *Mid-Century.*

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